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Abstract

NIST has completed Phase II.A of a project to study the impact of HVAC systems on residential indoor air quality and to assess the potential for using residential forced-air systems to control indoor pollutant levels. In this effort, NIST is performing whole building airflow and contaminant dispersal computer simulations with the program CONTAM93 to assess the ability of modifications of central forced-air heating and cooling systems to control pollutant sources relevant to the residential environment. This report summarizes the results of Phase II.A of this project, which consisted of three major efforts: baseline simulations of contaminant levels without indoor air quality (IAQ) controls, design of the IAQ control retrofits, and preliminary simulations of contaminant levels with the IAQ control retrofits. In Phase II.B of the study, all of the baseline cases will be modified to incorporate the IAQ control retrofits. The retrofit results will then be compared to the baseline results to evaluate the effectiveness of the retrofits.

The pollutant concentrations in a building depend on many factors including the configuration of the building zones, the air leakage of the building envelope and of interior partitions, wind pressure profile on the building envelope, pollutant source strengths and temporal profiles, heating and cooling system airflow rates, furnace filter efficiency, characteristics of reversible pollutant sinks in the building, individual pollutant decay or deposition rates, and ambient weather and pollutant concentrations. This report describes the input data used to model the baseline houses with CONTAM93 and presents the results of the baseline simulations in the form of the transient pollutant concentrations for selected simulations and a summary of peak and average concentrations for all baseline simulations. Three indoor air quality control technologies were then selected for incorporation into the baseline house models to determine their effectiveness in controlling the modeled pollutant sources. The technologies include the following: electrostatic particulate filtration, heat recovery ventilation, and an outdoor air intake damper on the forced-air system return. Selected baseline cases were then modified to implement these indoor air quality control retrofits, and preliminary simulations were performed to demonstrate the ability of the program to model the control technologies.

Key Words: airflow modeling, building technology, computer simulation, filtration, heat recovery ventilator, HVAC system, indoor air quality, infiltration, residential buildings, ventilation

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Introduction

Despite the increasing interest in residential indoor air quality (IAQ) problems, only limited research has been conducted which integrates the analysis of pollutant sources, residential heating and cooling system operation, and building characteristics. While central forced-air heating and cooling systems may provide solutions to some IAQ problems, such an integrated approach is required to analyze these options. Because large quantities of indoor air circulate through these systems, they offer the potential for treating the indoor air and then distributing this treated air through the system ductwork to the building. Also, outdoor air brought into the building by the forced-air system can be distributed throughout the building by this ductwork. Most modeling studies of IAQ in residential buildings have employed very simple models of the building and its systems, ignoring the multizone nature of the airflows involved. The use of such simple analytical procedures has limited our understanding of the impact of central forced-air heating and cooling systems on residential IAQ and the possibility of using these and other systems to mitigate IAQ problems.

The National Institute of Standards and Technology (NIST) is conducting a study for the U.S. Consumer Product Safety Commission (CPSC) to assess the potential effectiveness of existing heating, ventilating, and air conditioning (HVAC) technology to reduce the levels of selected pollutants in single-family residential buildings. This effort is employing a new multizone airflow and contaminant dispersal modeling program, CONTAM93 (1). In this effort, NIST is performing whole building airflow and contaminant dispersal computer simulations to assess the ability of modifications of central forced-air heating and cooling systems to control pollutant sources relevant to the residential environment. Phase I of the project included conducting a literature review, developing a detailed simulation plan, and hosting a workshop to discuss the project, and was described in a previous report (2). This report summarizes the results of Phase II.A which consisted of three major tasks: baseline simulations of contaminant levels without IAQ controls, design of the IAQ control retrofits, and preliminary simulations of contaminant levels with the IAQ control retrofits in place.

In Phase II.B of the study, the baseline HVAC systems will be modified to incorporate the IAQ control technologies described in this report and simulations will be performed for all conditions under which baseline simulations were performed. The Phase II.B simulation results will be compared with the results presented here to determine the effectiveness of the IAQ modifications at controlling the selected pollutant sources.

Contents of Report

The first section of the report describes the baseline simulations performed. The program CONTAM93 (1) was used to calculate airflows and pollutant distributions for the houses and pollutant sources described in the report on Phase I of the project (2). The houses modeled are not based on real buildings but are intended to be representative of typical buildings. This first section presents the input data used to describe the houses, HVAC systems, pollutants, sources, and boundary conditions in the baseline simulations. In addition, this section summarizes the

results of the baseline simulations including transient pollutant concentrations for selected simulations and a summary of peak and average concentrations for all baseline simulations.

The second section describes the indoor air quality control technologies that will be evaluated in the computer simulations during Phase II.B. These technologies will be incorporated into the baseline house models to determine their effectiveness in controlling the selected pollutant sources. The three technologies described in this section include electrostatic particulate filtration, heat recovery ventilation, and an outdoor air intake damper on the forced-air system return. This section describes each of these technologies and includes revisions of the baseline house duct drawings. In addition, this section contains an estimate of the equipment and installation costs and a revision of the thermal load calculations based on the modifications. Finally, the impacts of each of these technologies on "other contaminants" are discussed qualitatively. These other contaminants, as described in the original project work statement, include contaminants that have typically been of concern to designers of residential ventilation systems including cooking odors, tobacco smoke, moisture, outdoor pollen, outdoor odors and ozone.

The third section presents the results of preliminary simulations of the IAQ control retrofits. These simulations involved modifying selected baseline simulation cases with the three IAQ control retrofits. The preliminary simulations were performed to demonstrate the ability of the program to model the IAQ control technologies.

The report includes two appendices. The first appendix describes modeling performed to characterize the airflow in the houses including the results of fan pressurization simulations and whole house infiltration simulations. The second appendix includes summary tables of the baseline and preliminary simulation results.

Baseline Simulations

This section of the report describes the baseline simulations performed in Phase II.A. This section presents the input data describing the houses, HVAC systems, pollutants, sources, and boundary conditions modeled in the baseline simulations. In addition, this section summarizes the results of the baseline simulations including transient pollutant concentrations for selected simulations and a summary of peak and average concentrations for all baseline simulations.

Baseline Simulation Input Data

Calculating airflow rates and contaminant concentrations with CONTAM93 or any other multizone model requires the following input: the configuration and volume of the building zones, the air leakage paths through the building envelope and interior walls, wind pressure profile on the building envelope, pollutant source strengths and temporal profiles, HVAC system flows, furnace filter efficiency, characteristics of reversible pollutant sinks, individual pollutant decay or deposition rates, and ambient weather and pollutant concentrations. This section describes the input data used in the baseline simulations.

The study included eight building models - a ranch and a two-story house, located in two sites (Miami and Minneapolis), with typical and low values of airtightness. The Phase I NISTIR (2) described the layout and dimensions of each house and contained floorplan drawings. Simulations were performed under three sets of weather conditions (cold, mild, and hot) for each building. Each simulation was performed for a one-day cycle repeated until peak concentrations converged to a specified tolerance. Referring to all pollutant sources modeled for a single building as one simulation, there were a total of 24 baseline simulation cases. Table 1 lists the baseline simulations by house type, location, airtightness and weather condition.

Table 1 - Baseline simulations

Simulation	House type	Location	Airtightness	Weather
SIM1FLC	ranch	Miami	typical	cold
SIM1FLM	ranch	Miami	typical	mild
SIM1FLH	ranch	Miami	typical	hot
SIM1FTC	ranch	Miami	tight	cold
SIM1FTM	ranch	Miami	tight	mild
SIM1FTH	ranch	Miami	tight	hot
SIM1MLC	ranch	Minneapolis	typical	cold
SIM1MLM	ranch	Minneapolis	typical	mild
SIM1MLH	ranch	Minneapolis	typical	hot
SIM1MTC	ranch	Minneapolis	tight	cold
SIM1MTM	ranch	Minneapolis	tight	mild
SIM1MTH	ranch	Minneapolis	tight	hot
SIM2FLC	two-story	Miami	typical	cold
SIM2FLM	two-story	Miami	typical	mild
SIM2FLH	two-story	Miami	typical	hot
SIM2FTC	two-story	Miami	tight	cold
SIM2FTM	two-story	Miami	tight	mild
SIM2FTH	two-story	Miami	tight	hot
SIM2MLC	two-story	Minneapolis	typical	cold
SIM2MLM	two-story	Minneapolis	typical	mild
SIM2MLH	two-story	Minneapolis	typical	hot
SIM2MTC	two-story	Minneapolis	tight	cold
SIM2MTM	two-story	Minneapolis	tight	mild
SIM2MTH	two-story	Minneapolis	tight	hot

Detailed information on building component leakage of the houses is not available as the houses modeled were not based on real buildings. However, since there is no attempt to compare predictions with experimental data, the building leakage modeled needs only to be reasonable in magnitude and distribution. Table 2 shows all of the leakage paths between the zones of the Miami ranch house (see Figure 1 for the ranch house floorplan and zone labeling and Figure 2 for the two-story house floorplan and zone labeling). The Minneapolis houses have basements (zone label BMT) that are not shown in the figures. Table 3 lists the values for those leakage paths for both the typical and tight cases. The Table 3 leakage areas are for a reference pressure difference of 4 Pa and a discharge coefficient of 1.0 and are based on values listed in Table 23-3 of ASHRAE (3) unless otherwise noted. The typical values were generally based on "best estimate" and/or uncaulked entries in the ASHRAE table, while the tight values were based on minimum and/or caulked entries. All doors connecting zones other than closets were modeled as open. The same leakage values were used for the other houses, although the paths connecting the zones differed depending on the house configurations.

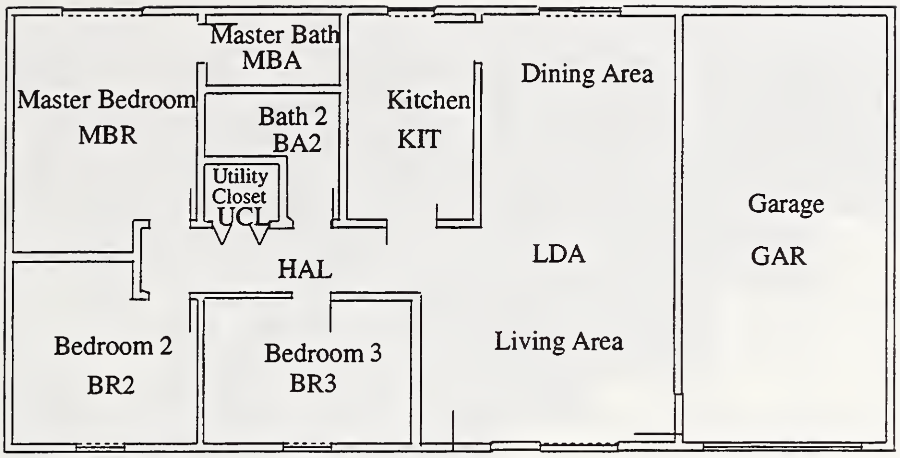

Figure 1 - Ranch house floorplan and zones

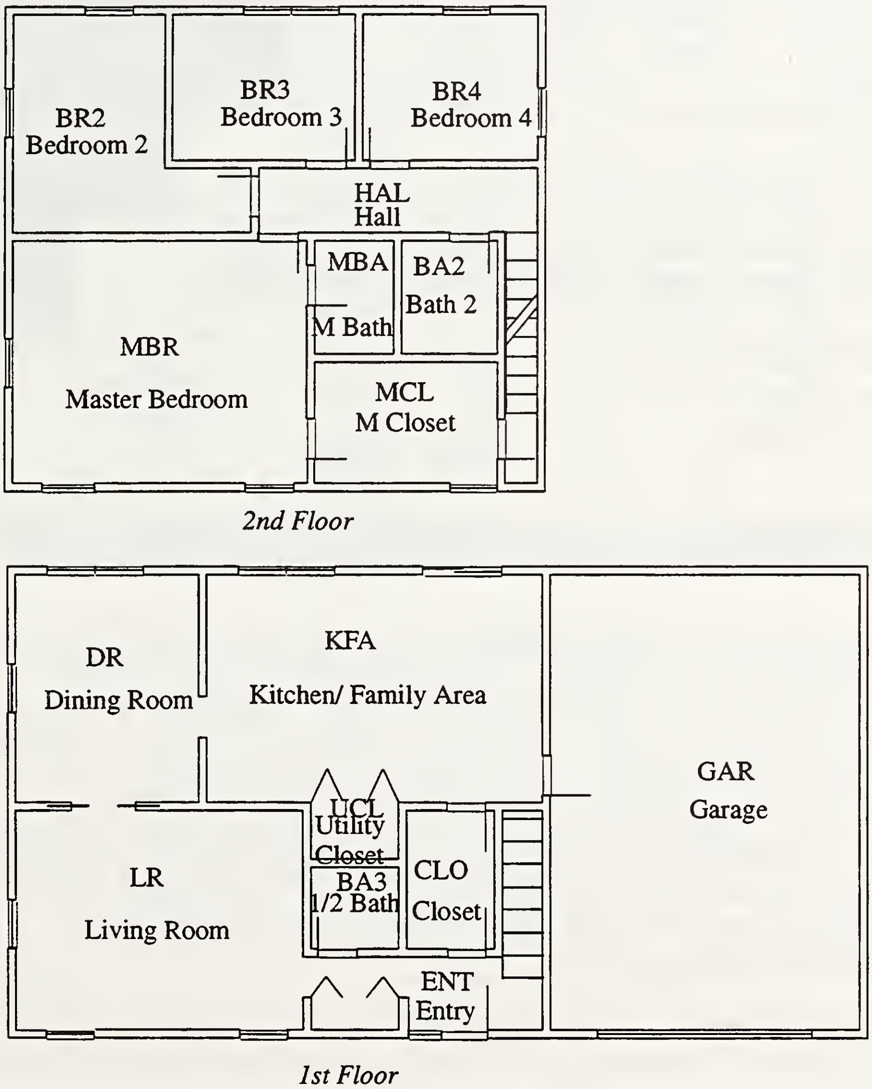

Figure 2 - Two-story house floorplan and zones

Table 2 - Air leakage paths for Miami ranch house

	MBR	BR2	BR3	MBA	BA2	UCL	KIT	LDA	HAL	GAR	ATC
BR2	INTW OUTL										
BR3		INTW OUTL									
MBA	INTD INTW										
BA2	INTW OUTL			INTW OUTL							
UCL	INTW				INTW						
KIT				INTW OUTL	INTW OUTL						
LDA			INTW OUTL				INTW INTD OUTL				
HAL	INTD INTW	INTD INTW	INTD INTW OUTL		INTD INTW	CLD INTW	INTD INTW OUTL	HAD			
GAR								EXTD EXW OUTL			
ATC	CEIL CPEN	CEIL CPEN	CEIL CPEN	CEIL CPEN PIP	CEIL CPEN PIP	CEIL CPEN	CEIL CPEN	CEIL CPEN CPEN	CEIL ATD		
AMB	WIN EXW OUTL	WIN EXW OUTL	WIN EXW OUTL	EXV EXW OUTL	EXV		WIN EXV EXW OUTL	SGD EXTD WIN EXW OUTL		GAD GARF EXW	VNT
	MBR	BR2	BR3	MBA	BA2	UCL	KIT	LDA	HAL	GAR	ATC

The infiltration through a building's envelope also depends on the static pressure distribution created by the wind on the building's exterior surfaces. The relationship between wind and surface pressures are characterized by wind pressure coefficients which depend on the wind direction, the building shape, the position on the building surface, and the presence of shielding near the building. The surface pressure coefficients for the building walls were based on Equation 23-8 of ASHRAE (3). The coefficient for the flat garage roof was based on Figure 14-6 of ASHRAE (3). The ASHRAE wind pressure coefficients do not include shielding effects and no modifier for shielding effects was used, however, recent studies have reported on the shielding effects of trees (4) and rows of houses (5).

Table 3 - Air leakage values

Name	Description	Typical	Tight
ATD	Attic door	30 cm^2/ea	18 cm^2/ea
CEIL	Ceiling [Based on general ceiling]	1.8 cm^2/m^2	0.79 cm^2/m^2
CLD	Closet door (closed) [Based on interior door]	0.9 cm^2/m	0.25 cm^2/m
	Closet door frame [Based on general door frame]	25 cm^2/ea	12 cm^2/ea
CPEN	HVAC ceiling penetration [Based on kitchen vent with damper closed]	5 cm^2/ea	1 cm^2/ea
EXTD	Exterior door [Single]	21 cm^2/ea	12 cm^2/ea
	Door frame [Wood]	1.7 cm^2/m^2	0.3 cm^2/m^2
EXV	Bathroom exhaust vent	20 cm^2/ea	10 cm^2/ea
	Kitchen exhaust vent	40 cm^2/ea	5 cm^2/ea
EXW	Ceiling-wall joint	1.5 m^2/m	0.5 m^2/m
	Floor-wall joint	4 cm^2/m	0.8 cm^2/m
	Wall-wall joint [Based on ceiling-wall joint]	1.5 m^2/m	0.5 m^2/m
GAD	Garage door [Based on general door (2 m x 4 m)]	0.45 cm^2/m	0.31 cm^2/m
	Garage door frame [Wood]	1.7 cm^2/m^2	0.3 cm^2/m^2
GARF	Garage roof [Based on general ceiling]	1.8 cm^2/m^2	0.79 cm^2/m^2
HAD	Hall doorway	2.4 m^2/ea	2.4 m^2/ea
INTD	Interior door (closed) [Based on Table 4.2 of Klote and Milke (6)]	140 cm^2/ea	75 cm^2/ea
	Interior door (open)	2.1 m^2/ea	2.1 m^2/ea
INTW	Interior wall [Based on gypsum board on stud wall (Shaw et al. 7)]	2.0 cm^2/m^2	2.0 cm^2/m^2
OUTL	Electric outlet	2.5 cm^2/ea	0.5 cm^2/ea
PIP	Piping penetrations	6 cm^2/ea	2 cm^2/ea
SGD	Sliding glass door	22 cm^2/ea	3 cm^2/ea
VNT	Attic vent [Based on Table 21-1 of 3]	1 cm^2 / 300 cm^2	1 cm^2 / 300 cm^2
WIN	Double hung window	2.5 cm^2/m	0.65 cm^2/m
	Window framing [Wood]	1.7 cm^2/m^2	0.3 cm^2/m^2

The building HVAC systems were designed in Phase I of the study and are described in the Phase I report (2). This earlier report contains the heating and cooling equipment types and descriptions, overall and individual supply and return airflow rate design values for both heating and cooling, and drawings showing the system equipment and duct locations and duct sizes. In addition to this information, CONTAM93 requires information on the system operation, specifically, an on-off schedule. The schedule was determined by calculating the fractional on-time required to meet the cooling or heating load for each 3-hour period of the day. A control profile incorporating this schedule was then input for each simulation. For the baseline simulations, the HVAC systems included standard furnace filters with constant efficiencies of 5% for fine particles and 90% for coarse particles. Fine particles are defined as having a diameter less than 2.5 μm (the efficiency is based on a diameter of 0.6 μm); coarse particles are defined as having a diameter greater than 2.5 μm (the efficiency is based on a diameter of 6 μm). These

efficiency values are based on assumed arrestance for these filters of about 90% and a review of manufacturers' test data. No outdoor air intake is included for the baseline HVAC systems.

Another important consideration for the HVAC systems is duct leakage. Since the duct system itself is not modeled in these simulations, duct leakage is modeled by including an additional system supply or return point and reducing the other supply and return flows by the corresponding amount rather than by an effective leakage area. Cummings et al. 1991 (8) tested duct leakage in 160 houses in Florida and found that return leaks were dominant in the majority of homes. They reported an average return leak fraction of 10.7% (based on ratio of leakage flow to total system flow). For the Minneapolis houses, a return leak of 10% was included in the basement. For the Miami ranch house, a supply leak of 10% was included in the attic because the system has a central return. For the Miami two-story house, no leaks were included because all ducts and equipment are internal . The air distribution system layouts were designed based on guidelines published by the National Association of Home Builders (9) and drawings are included in the Phase I report (2).

The ambient boundary conditions required by CONTAM93 include weather and outdoor pollutant concentrations. The weather conditions were chosen by selecting a hot, mild, and cold day for each location from Weather Year for Energy Calculation (WYEC) data (10). The WYEC data is presented in Tables 5 and 6 for Miami and Minneapolis, respectively, and includes temperature, wind speed, and wind direction from north.

Table 5 - Miami weather data

	Cold			Mild			Hot		
Hour	T (°C)	V_{wind} (m/s)	Dir (°)	T (°C)	V_{wind} (m/s)	Dir (°)	T (°C)	V_{wind} (m/s)	Dir (°)
0	2.8	2.3	320	13.3	3.9	360	26.7	0	0
1	2.8	2.3	300	13.3	2.7	360	26.1	1.2	200
2	2.8	3.5	310	13.3	3.5	360	26.1	1.2	200
3	2.8	2.7	320	13.9	1.9	20	25.6	1.6	200
4	2.2	2.3	310	13.3	2.7	20	25.6	1.9	200
5	2.2	3.5	310	13.9	1.6	360	26.1	1.9	230
6	2.8	2.7	320	13.3	2.3	340	25.6	1.9	200
7	3.3	3.5	300	14.4	2.3	340	26.7	1.6	230
8	4.4	2.3	290	16.1	2.7	340	27.2	1.9	200
9	6.1	2.7	330	21.1	4.7	70	30.6	2.3	200
10	8.9	3.1	320	23.3	4.7	70	31.7	2.3	230
11	11.7	2.3	320	23.3	5.1	70	32.8	0	0
12	13.9	2.7	330	23.3	5.4	70	33.3	2.3	200
13	14.4	2.7	350	22.8	5.1	70	33.3	3.9	140
14	16.1	2.3	360	22.8	5.4	70	32.8	4.3	180
15	17.2	0.8	40	22.2	4.7	70	31.7	4.7	160
16	17.8	2.7	40	21.7	3.9	90	30.6	1.9	290
17	17.2	3.5	20	21.7	3.1	90	31.7	3.1	140
18	16.7	1.9	340	21.7	4.3	70	30.6	2.3	160
19	16.1	2.3	340	21.1	4.3	90	27.8	1.6	50
20	15	1.6	350	21.1	2.7	90	27.8	1.2	50
21	14.4	1.9	350	21.1	3.1	90	27.2	1.6	200
22	16.1	2.3	30	21.7	1.2	90	26.1	2.3	230
23	16.1	2.3	60	21.7	2.3	90	26.1	1.2	250
24	17.2	3.5	60	20.6	3.1	50	26.1	0	0

Table 6 - Minneapolis weather data

	Cold			Mild			Hot		
Hour	T (°C)	V_{wind} (m/s)	Dir (°)	T (°C)	V_{wind} (m/s)	Dir (°)	T (°C)	V_{wind} (m/s)	Dir (°)
0	-21.1	1.6	330	7.8	1.9	60	21.1	3.1	180
1	-21.1	1.6	330	7.8	1.9	40	20	2.7	180
2	-21.1	3.1	350	7.8	3.1	90	18.9	2.7	180
3	-21.1	3.1	350	7.2	1.9	100	17.8	1.9	180
4	-21.1	3.1	350	7.2	4.7	130	18.3	1.6	158
5	-21.1	3.1	350	7.2	3.9	130	17.2	2.7	135
6	-21.7	3.5	350	7.2	3.1	120	17.8	3.5	158
7	-21.7	2.7	340	7.2	3.9	140	20	1.9	158
8	-21.7	2.7	350	7.8	2.7	120	24.4	4.7	180
9	-21.1	3.9	340	8.9	3.1	130	26.1	5.8	180
10	-20.6	3.9	310	7.8	4.3	130	28.3	6.6	203
11	-20.6	4.7	310	8.3	4.7	130	30	6.2	203
12	-20.6	3.9	320	8.9	4.3	140	30.6	6.2	203
13	-20.6	4.3	320	8.9	4.7	140	31.1	7	203
14	-20	5.1	300	8.3	6.2	120	31.1	7.4	203
15	-20	4.7	290	8.9	6.2	110	31.1	6.6	203
16	-20.6	4.3	310	8.9	5.8	130	31.1	6.6	203
17	-21.1	3.5	290	9.4	5.1	130	28.9	4.7	203
18	-22.8	3.1	280	9.4	5.4	130	29.4	4.7	180
19	-23.3	2.7	280	11.1	5.4	160	27.8	4.7	180
20	-24.4	3.1	300	11.7	5.8	170	26.1	4.3	180
21	-25	3.1	280	11.1	6.2	180	24.4	3.9	180
22	-25.6	2.7	280	11.1	5.8	200	23.9	3.9	180
23	-27.2	2.3	240	10.6	6.2	220	23.3	4.7	158
24	-28.9	2.3	240	7.8	2.7	240	22.8	4.3	180

Outdoor pollutant concentrations vary by location and over time at any one location. The concentrations used as boundary conditions for the indoor sources in the simulations were selected as typical outdoor conditions and are not meant to represent the actual conditions at any specific location. The values used were specified per the schedules in Table 7. The CO and NO_2 concentrations were chosen based on review of US EPA air quality documents (11, 12, 13). They were chosen to have a diurnal pattern with morning and afternoon peaks. The selected CO and NO_2 concentration schedules are very similar to values measured outside a research house in Chicago (Figure 3.2 of 14). Fine particles and TVOCs are not discussed in the EPA documents. The ambient fine particle concentration was chosen based on the average of reported average measurements for four US cities (Table 4 of 15). The TVOC concentration chosen is in the

middle of the reported range of 10 to 211 μg/m^3 measured at 68 sites in the US (16). The fine particle and TVOC concentrations were assumed to be constant throughout the day.

In addition to the ambient concentrations in Table 7 that served as the boundary conditions for the indoor sources, elevated levels of CO, coarse particles, and NO_2 were simulated in order to evaluate the effect of the IAQ control technologies on pollutants brought into residences from the outdoors. These elevated pollutant concentrations were selected based on review of US EPA air quality documents (11, 12, 13) and were specified per the schedules in Table 8.

Table 7 - Outdoor pollutant concentration schedules

Hour of day	0 - 7	7 - 9	9 -17	17 - 19	19 - 24
CO (ppm)	1	2	1.5	3	1.5
NO_2 (ppm)	0.02	0.04	0.02	0.04	0.02
Fine particles (μg/m^3)	13	13	13	13	13
TVOCs (μg/m^3)	100	100	100	100	100

Table 8 - Elevated outdoor pollutant concentrations schedule

Hour of day	0 - 7	7 - 9	9 -17	17 - 19	19 - 24
CO (ppm)	4	8	7	12	6
NO_2 (ppm)	0.2	0.4	0.2	0.4	0.2
Coarse particles (μg/m^3)	75	75	75	75	75

The Phase I report (2) described the pollutant sources considered for inclusion in the study. The pollutant sources used in the baseline simulations included several VOC burst sources (medium strength source based on a polish and high strength source based on a spray carpet cleanser (17)), a constant VOC area source (based on a PVC flooring material with high emissions (18)), and combustion sources (based on medium source strengths for ovens and space heaters (19)) of CO, NO_2, and fine particles. While the source strength used for the flooring material isbased on a material with high emissions, it is only moderately higher than the range of 0.17 to 2.11 mg/m^{2}h recently reported in 5 day emission tests of finished particleboard (20). Table 9 lists detailed information on these sources including the zones (see Figures 1 and 2 for zone labels, also BMT is the basement zone) in which they are located, source strengths, and schedules.

Table 9 - Pollutant sources

Source name	Pollutant	Zone(s)	Source strength	Schedule
Burst (medium)	TVOCs	Several	300 mg/h	9 - 9:30 am 7 - 7:30 p.m.
Burst (high)	TVOCs	GAR and BMT	1100 mg/h	9 - 10 am 7 - 8 p.m.
Flooring material	TVOCs	All but GAR, ATC	7.0 mg/h m^2	constant
Oven	CO	KIT (ranch house), KFA (two-story house)	1900 mg/h	7 - 7:30 am 6 - 7 p.m.
Oven	NO_2	KIT (ranch house), KFA (two-story house)	160 mg/h	7 - 7:30 am 6 - 7 p.m.
Oven	Fine particles	KIT (ranch house), KFA (two-story house)	0.2 mg/h	7 - 7:30 am 6 - 7 p.m.
Heater	CO	GAR and BMT	1000 mg/h	7 - 10 am (GAR) 7 - 9 p.m. (BMT)
Heater	NO_2	GAR and BMT	250 mg/h	7 - 10 am (GAR) 7 - 9 p.m. (BMT)
Heater	Fine particles	GAR and BMT	2 mg/h	7 - 10 am (GAR) 7 - 9 p.m. (BMT)

In addition to the sources listed in Table 9, the simulation plan in the Phase I report (2) included a newly-finished floor as a floor-area based decaying source of VOCs. A test simulation with a medium strength source, modeled as a first order exponential decay source with initial emission rate of 17400 mg/m^2h and decay constant of 1.24 h^{-1} (based on a stain product (21)) was performed for the Miami ranch house. This source resulted in extremely high concentrations of TVOCs with a peak concentration of over 2 g/m^3 and a concentration of 37 mg/m^3 at the end of the day. None of the IAQ control retrofits being evaluated can be expected to have a significant impact on the extremely high concentrations from this source during the one-day simulation period. Therefore, this source was not included in the remaining baseline simulations. Decaying high-strength sources such as this one are of interest and may be studied in the future with simulations of longer duration.

Reversible sink effects for the VOCs were modeled with sink elements based on a boundary layer diffusion controlled (BLDC) model with a linear adsorption isotherm. The BLDC adsorption model is described by Axley (22). The parameters required for this sink model are the film mass transfer coefficient, the adsorbent mass, and the isotherm partition coefficient, and these parameters would vary over time and by location within a house. However, since little real data is available for these parameters (which depend on factors such as gas diffusion properties, airflow rates, and adsorbent material) and because the goal was to obtain a reasonable estimate of the reversible sink effects, constant values were used for all of the parameters and only the adsorbent mass was varied by zone. The film mass transfer coefficient used was 35 μm/s and was calculated from equation 3.17a of Axley (22) with an assumed air velocity of 0.001 m/s, effective length of 4 m, Schmidt number of 1.0, and binary diffusion coefficient of 1.0×10^{-5} m^2/s. The partition coefficient used was 0.5 g-air/g-sorbent and was estimated from parameters reported for

an empirical sink model for an experimental case of alkanes emitted by a wood stain in a test house (23). The adsorbent mass used was based on a mass of 6 kg per m^2 of adsorbent surface area which was assumed to be equal to half of the zone interior surface area.

Nitrogen dioxide decay and particle deposition were modeled as single-reactant first order reactions with a single, constant value in all rooms of the houses. Nitrogen dioxide decay depends strongly on the materials present in a house (e.g., floor and wall coverings, furnishings, etc.) and a wide range of measured values have been reported including a range of 0.09 - 13.74 h^{-1} by Lee et al. (24). Other studies have reported average NO_2 decay rates of 0.17, 0.29, 0.65, 0.8, 0.82, and 2.07 h^{-1} (25, 26, 27, 28, 29, 24). The kinetic rate coefficient used for NO_2 decay was 0.87 h^{-1} and is based on the average of measurements in a contemporary research house reported by Leslie et al. (14).

Particle deposition depends on the size and type of particles, particle concentration, airflow conditions, and surfaces available for deposition. The particle decay rate used for fine particles was 0.08 h^{-1} and was reported by Traynor et al. (30) for combustion products from a wood-burning stove in a test house. Offerman et al. (31) reported a similar mass-averaged value of 0.1 h^{-1} for tobacco smoke particles in a research house. The decay rate can be calculated as the product of an average deposition velocity and a room surface-to-volume ratio. Assuming a room surface-to-volume ratio of 2 m^{-1} (the actual value will depend on room geometry, furnishings, and surface finishes), a decay rate of 0.08 h^{-1} corresponds to a deposition velocity of approximately 0.001 cm/s. Sinclair et al. (32, 33) reported higher average deposition velocities of 0.005 cm/s for fine-mode sulfate in telephone equipment buildings. However, the nature of the indoor environment, and especially the airflow conditions, in a detached single-family home and a commercial building are very different. Nazaroff et al. (34) discusses the use of deposition velocity and warns that "Deposition velocities determined for one indoor environment can only be applied to another to the extent that the air flow conditions are similar."

In the only report of coarse particle deposition rates in a test house found in the literature, Byrne et al. (35) reported values of 1.51 and 2.10 h^{-1} for 4 μm particles in an unfurnished and furnished room, respectively. The reported mean deposition velocities of 0.027 to 0.038 cm/s fall within the range of approximately .01 to 0.1 cm/s calculated from a natural convection deposition model by Nazaroff and Cass (36). The actual decay rate for the coarse outdoor air particles modeled in the simulations would depend on the size distribution of the particles. Since no specific distribution has been assumed , a decay rate of 1.5 h^{-1} was chosen based on the lower value reported by Byrne.

Baseline Simulation Results

The results of each of the 24 simulations listed in Table 1 include pollutant concentrations for up to 18 pollutants in each of the building zones for each 15-minute time step of the 24-hour simulation period. The complete transient simulation results are not presented here but are available in spreadsheet files. Instead, this section presents examples of the transient pollutant concentrations for selected simulations. Figures 3 through 6 show the pollutant concentrations in Zone LDA resulting from selected pollutant sources for simulation SIM1FLC (the typical Miami

ranch house in cold weather). Figures 7 through 10 show the corresponding results for SIM1FTC (the tight Miami ranch house in cold weather). Although these figures are only examples of transient results, some observations can be made into trends and factors affecting the predicted contaminant concentrations. A complete summary of peak and 24-hour, 4-hour, and 1-hour average concentrations for all baseline simulations are included in Tables 1a through 24e of Appendix B.

Figures 3 and 7 show the CO concentrations in Zone LDA resulting from the oven and heater sources (CO.1 and CO.2 in Tables 1 and 4 of Appendix B) for SIM1FLC and SIM1FTC, respectively. Both graphs show two daily peaks due to the operation of the oven. For the tight house, the peaks are shifted to a slightly later time due to reduced outdoor airflow into the house which resulted in less mixing of CO from the kitchen into the rest of the house. The heater source causes much lower concentrations than the oven source due to the low airflow rate from the garage into the house and the lower source emission rate. The resulting CO concentrations for the heater source are influenced primarily by the outdoor level. There is more damping of the outdoor variations in the tight house than the typical house due to the reduced air infiltration rate.

Figures 4 and 8 show the NO_2 concentrations (NO2.1 and NO2.2 in Tables 1 and 4 of Appendix B) in Zone LDA resulting from the oven and heater sources for SIM1FLC and SIM1FTC. The NO_2 concentrations show some of the same characteristics as the CO concentrations, with two peaks from the oven and a damped dependence on the outdoor concentration for the heater. However, the NO_2 peaks in the tight house are significantly less than in the typical house despite the reduced outdoor airflow into the house. In fact, the whole-house average NO_2 concentrations are lower in the tight house than in the typical house (0.025 ppm vs. 0.026 ppm for the oven source, and 0.003 ppm vs. 0.008 ppm for the heater source). These results may seem surprising as one might expect the reduced infiltration to result in higher NO_2 concentrations in the tight house. However, these results may be explained by the impact of NO_2 decay. The NO_2 in the house is either generated by the indoor sources or brought in from outside. During much of the day, when the combustion appliances are not operated, the outdoor air is the source of indoor NO_2 and, due to NO_2 decay, the indoor concentrations are lower than the outdoor concentration. Therefore, reducing the infiltration actually results in lower indoor NO_2 concentrations. When there is an indoor source of NO_2, a lower infiltration rate may still result in lower NO_2 concentrations in the zones without the source. However, the source-zone will have higher NO_2 concentrations when the infiltration rate is lower (the peak kitchen concentration from the oven is 1.686 ppm for the tight house and 1.434 ppm for the typical house). It is important to note that this result of lower NO_2 concentrations in tighter houses cannot be generalized to all cases. If the NO_2 decay rate was lower, the indoor NO_2 generation rate was higher, or the outdoor NO_2 concentration was lower, the tighter house could have higher concentrations. See Tables 1b and 4b of Appendix B for the peak and average NO_2 concentrations results for these simulations.

The TVOC concentrations in Zone LDA resulting from the burst source located in the LDA Zone (VOC4 in Tables 1 and 4 of Appendix B) are shown in Figures 5 and 9 for SIM1FLC and SIM1FTC. As expected, this source results in two daily peaks due to the source schedule and higher concentrations in the tight house due to the reduced airflow into the house.

Figures 6 and 10 show the CO and coarse particle concentrations (CO.3 and PART.3 of Tables 1 and 4 in Appendix B) for SIM1FLC and SIM1FTC, respectively, due to the elevated outdoor pollutant concentrations of Table 8. The CO concentration in the typical house tracks the outdoor concentration with a time lag based on the building time constant (related to the inverse of the building air change rate). The particle concentration shows the effect of the HVAC system cycling which changes the air change rate of the house and filters particles from the air. When the furnace is on, the concentration of coarse particles decreases due to the impact of the furnace filter. The tight house results exhibit damped CO peaks and valleys due to the longer time constants. Because the particles come from outdoors, the lower air change rates result in lower particle concentrations.

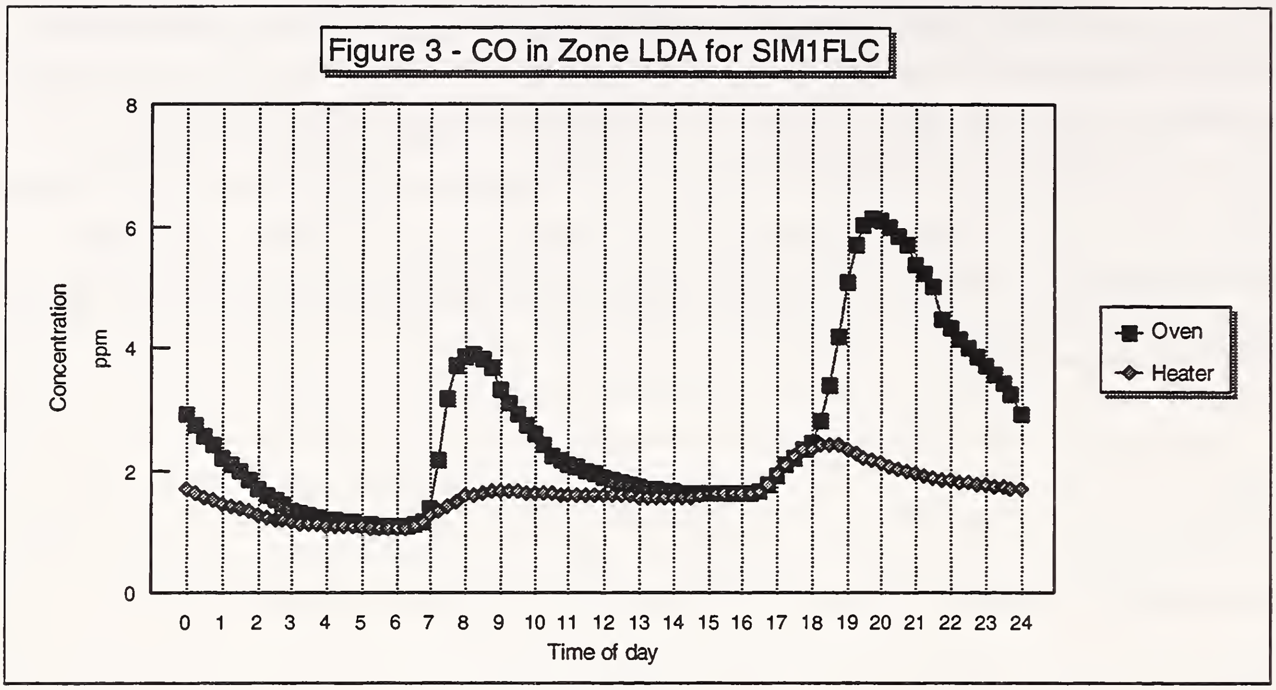

Figure 3 - CO in Zone LDA for SIM1FLC
Concentration
ppm
0
2
4
6
8
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Time of day
Oven
Heater

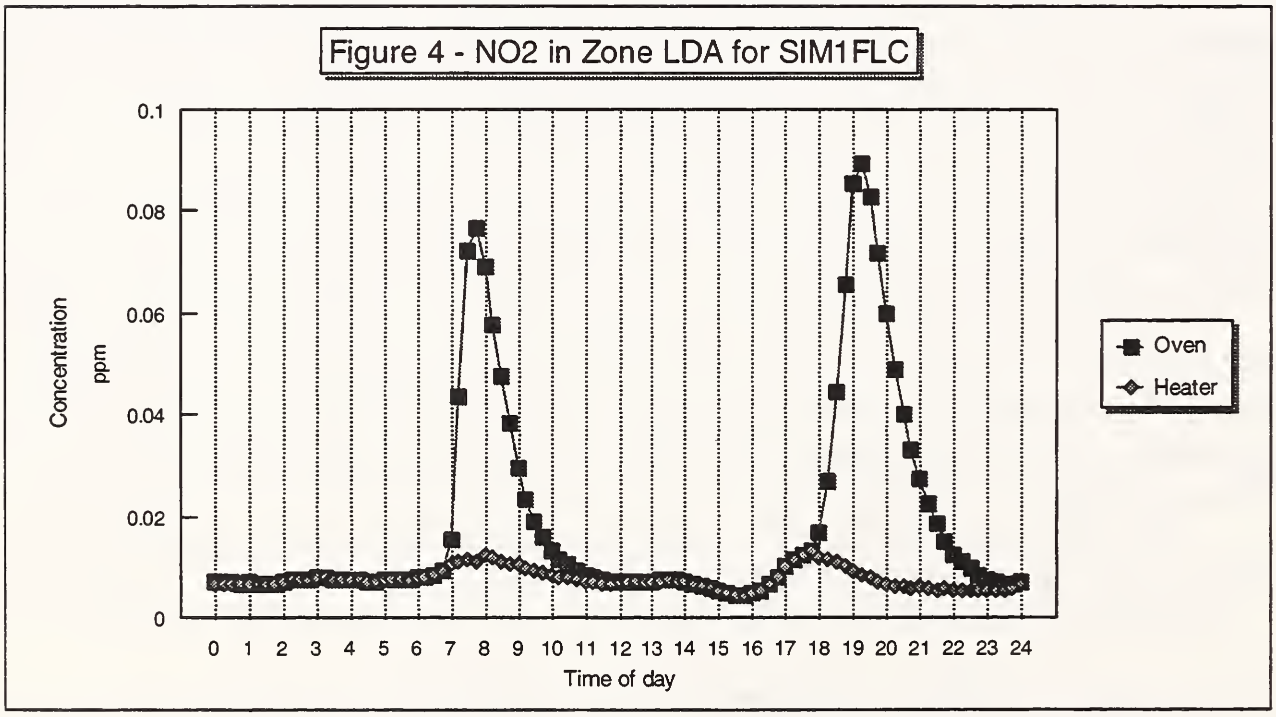

Figure 4 - NO2 in Zone LDA for SIM1FLC
Concentration
ppm
0
0.02
0.04
0.06
0.08
0.1
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Time of day
Oven
Heater

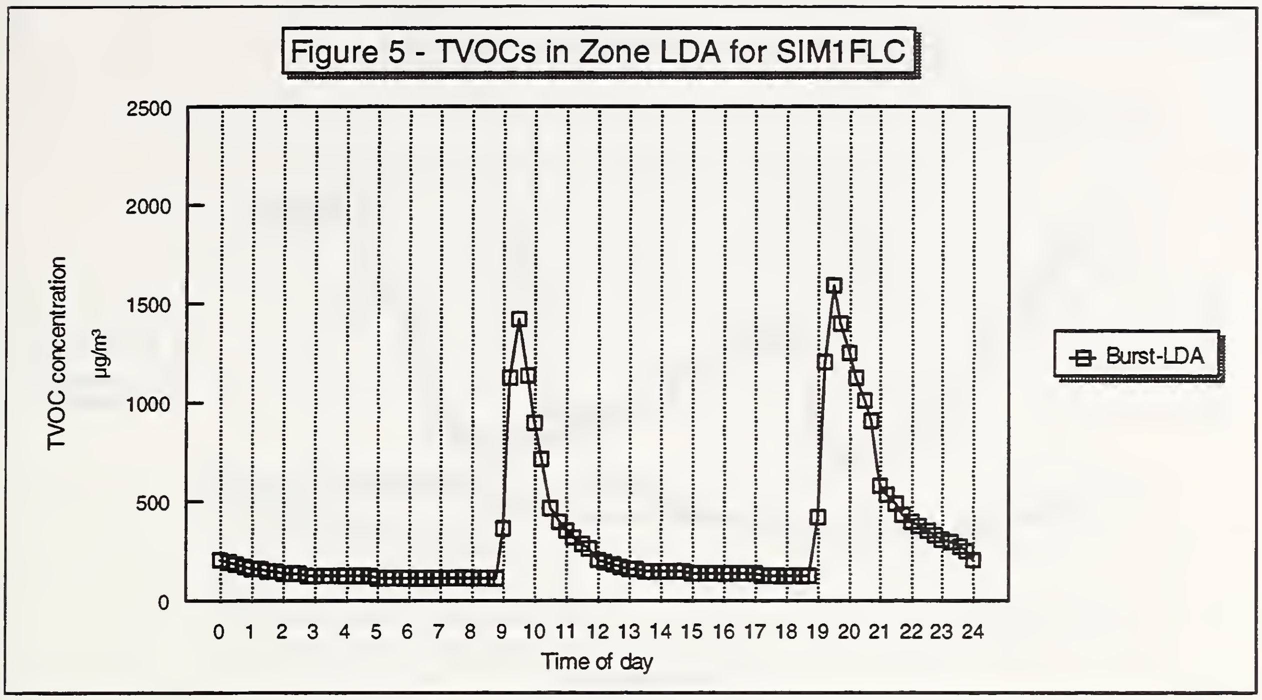
Figure 5 - TVOCs in Zone LDA for SIM1FLC
TVOC concentration
µg/m³
2500
2000
1500
1000
500
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Time of day
Burst-LDA

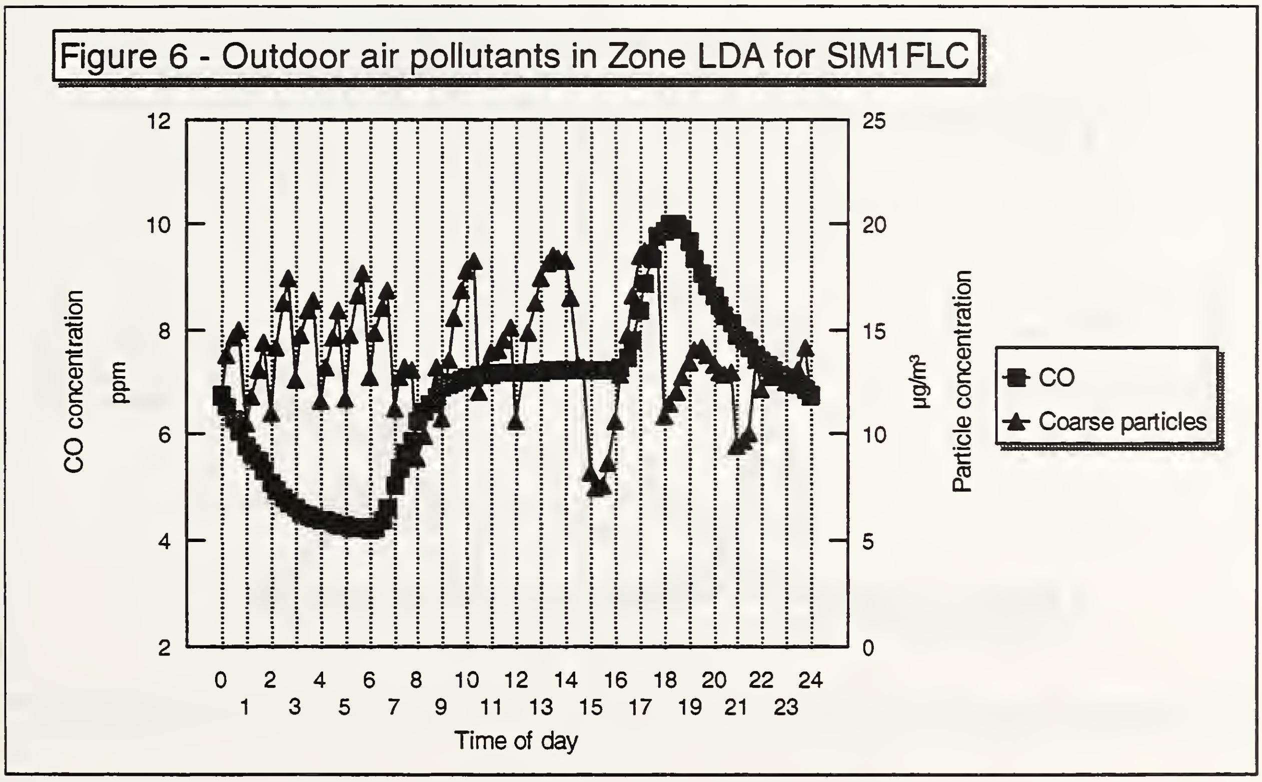
Figure 6 - Outdoor air pollutants in Zone LDA for SIM1FLC
CO concentration
ppm
12
10
8
6
4
2
25
20
15
10
5
0
Particle concentration
µg/m³
0 2 4 6 8 10 12 14 16 18 20 22 24
1 3 5 7 9 11 13 15 17 19 21 23
Time of day
CO
Coarse particles

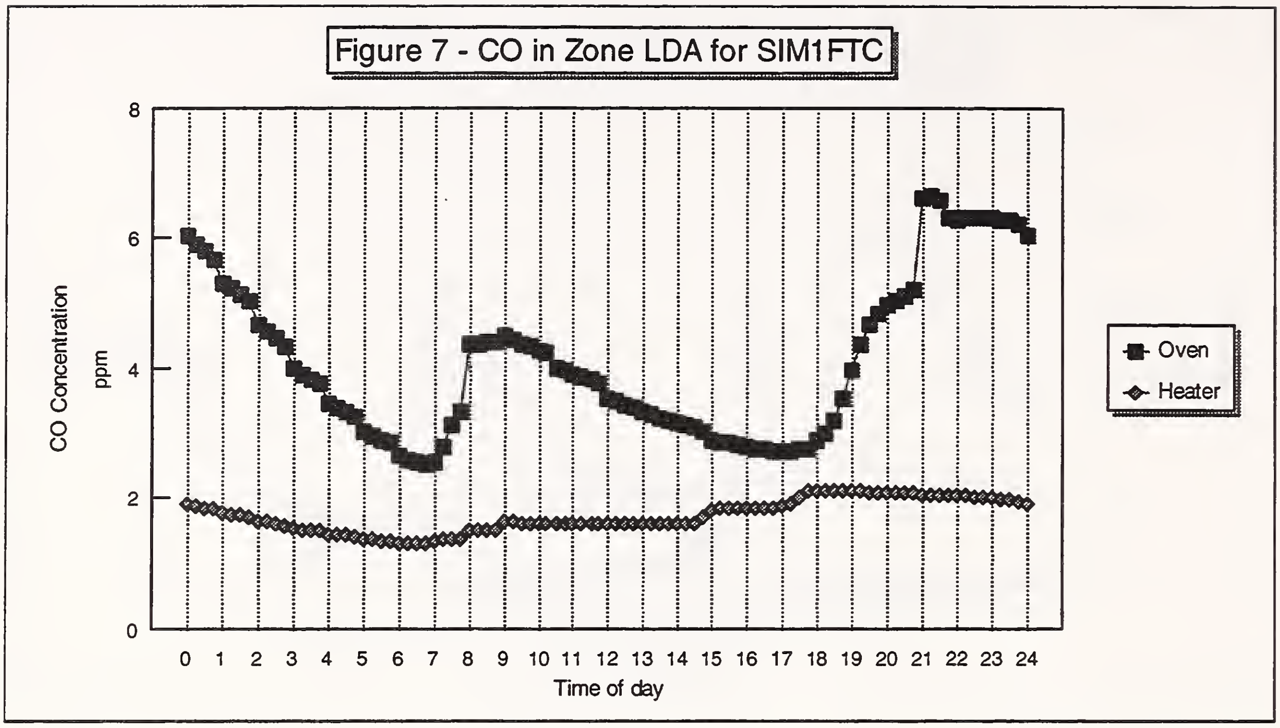

Figure 7 - CO in Zone LDA for SIM1FTC
CO Concentration
ppm
8
6
4
2
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Time of day
Oven
Heater

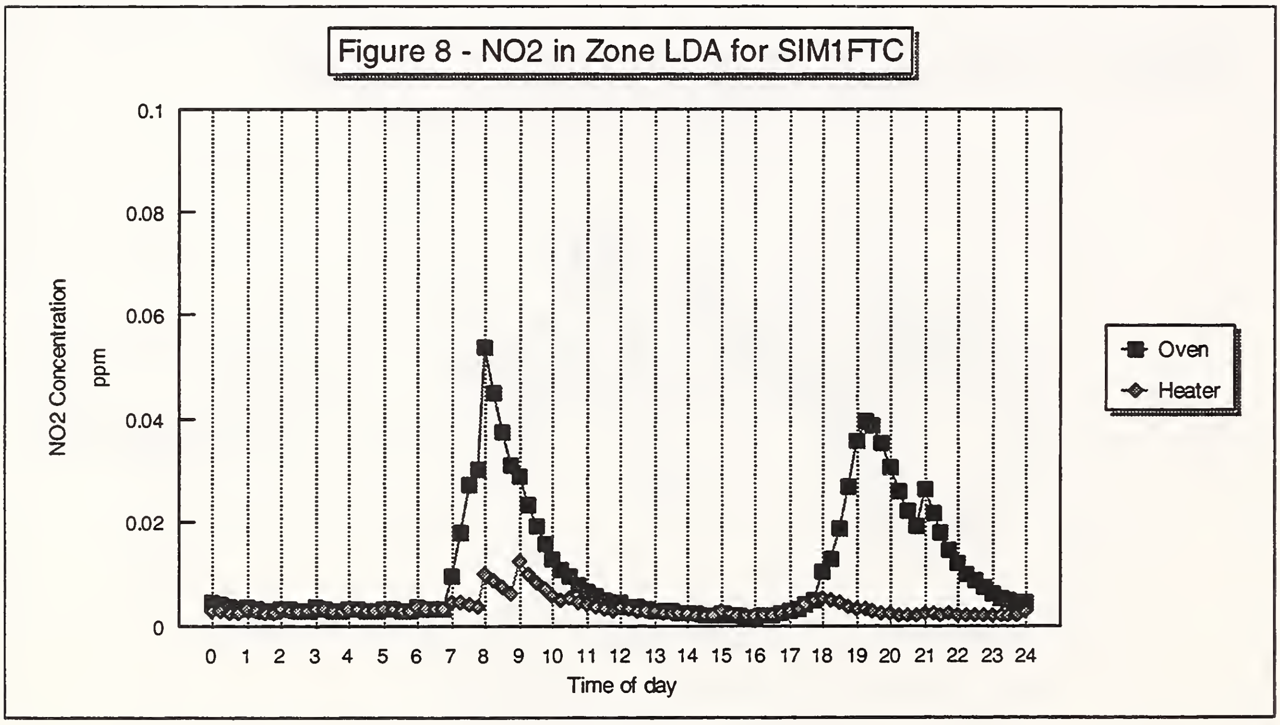

Figure 8 - NO2 in Zone LDA for SIM1FTC
NO2 Concentration
ppm
0.1
0.08
0.06
0.04
0.02
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Time of day
Oven
Heater

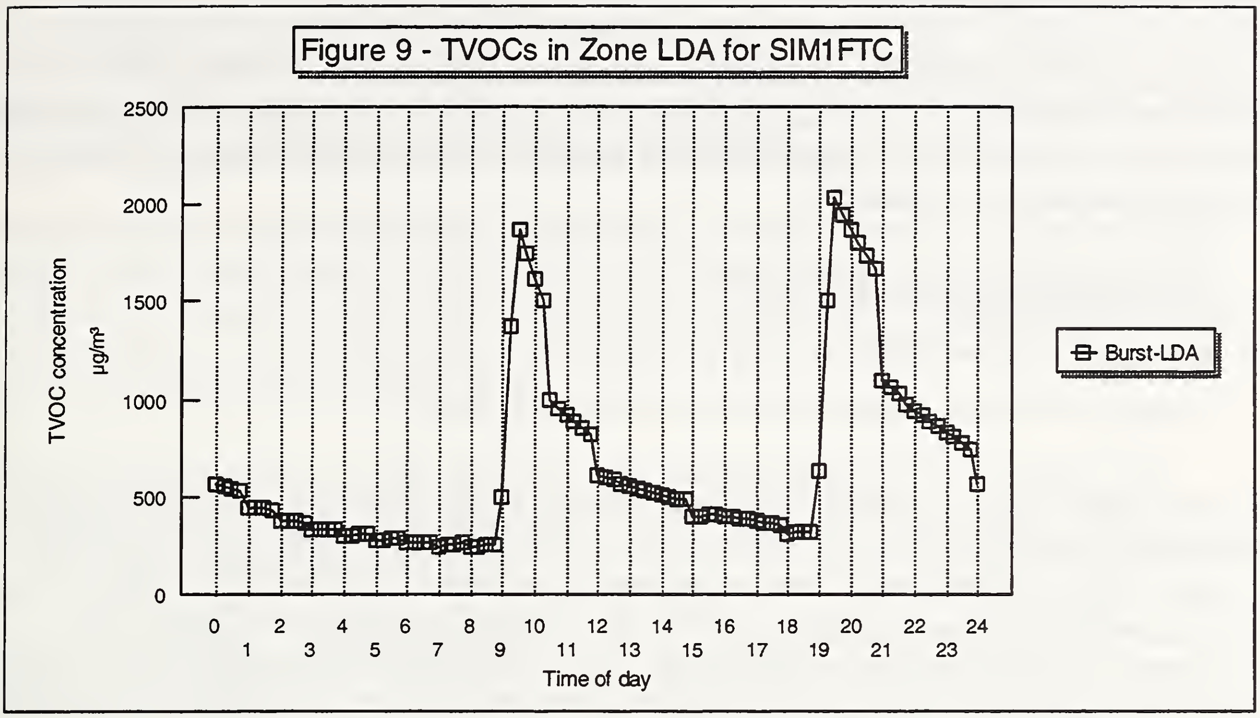
Figure 9 - TVOCs in Zone LDA for SIM1FTC
TVOC concentration
µg/m³
2500
2000
1500
1000
500
0
0 2 4 6 8 10 12 14 16 18 20 22 24
1 3 5 7 9 11 13 15 17 19 21 23
Time of day
Burst-LDA

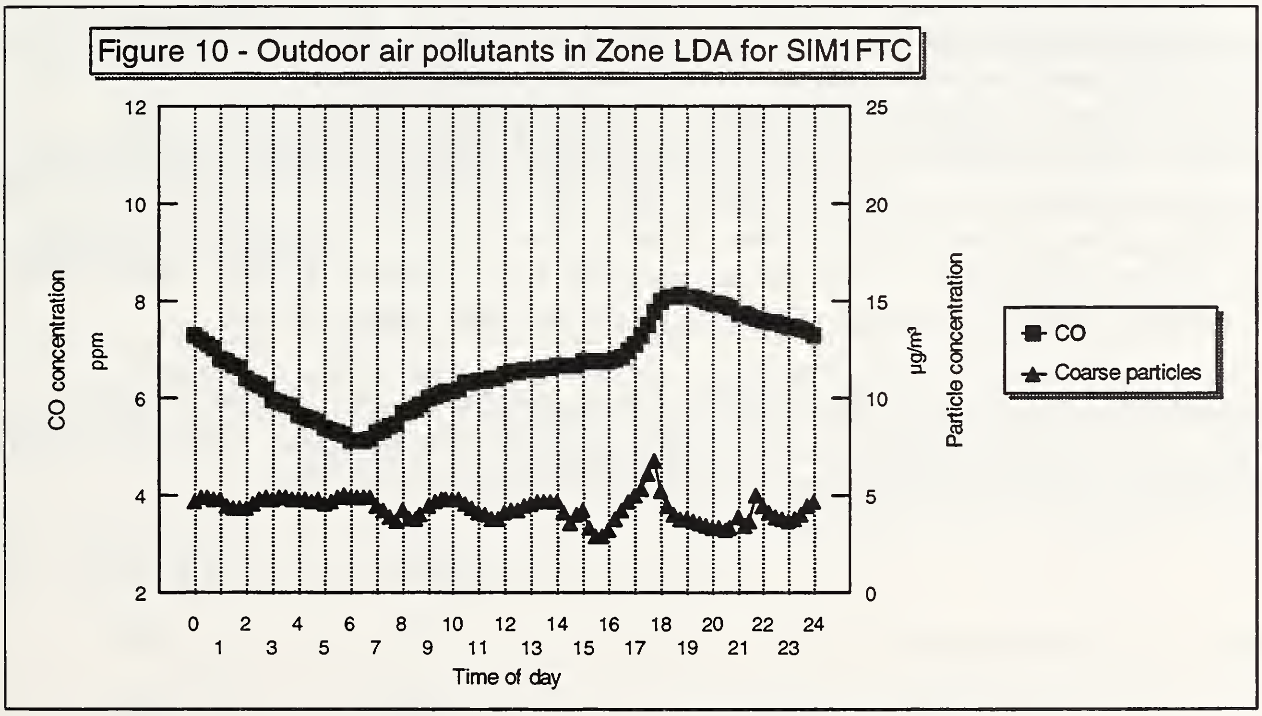
Figure 10 - Outdoor air pollutants in Zone LDA for SIM1FTC
CO concentration
ppm
12
10
8
6
4
2
25
20
15
10
5
0
Particle concentration
µg/m³
0 2 4 6 8 10 12 14 16 18 20 22 24
1 3 5 7 9 11 13 15 17 19 21 23
Time of day
CO
Coarse particles

Indoor Air Quality Controls

This section describes the indoor air quality control technologies that will be evaluated in the study. These technologies will be incorporated into the baseline house models to determine their effectiveness in controlling the selected pollutant sources. The three technologies described in this section include the following:

Electrostatic particulate filtration

Heat recovery ventilation

Outdoor air intake damper on the forced-air system return

This section describes each of these technologies and includes revisions of the baseline house duct drawings. In addition, this section contains an estimate of the equipment and installation costs and a revision of the thermal load calculations based on the modifications. Finally, the impacts of each of these technologies on "other contaminants" are discussed. These other contaminants, as described in the original project work statement, include contaminants that have typically been of concern to designers of residential ventilation systems including cooking odors, tobacco smoke, moisture, outdoor pollen, outdoor odors, and ozone.

Electrostatic Particulate Filtration

The first IAQ control technology is increased particulate filtration through the installation of passive, electrostatic particulate filters. These filters were chosen based on the availability of performance data. In addition, the low pressure drop through these filters enables their installation without modification of the existing forced-air distribution system. The baseline houses are assumed to have standard furnace filters with an ASHRAE dust spot efficiency of less than 20% and an arrestance of 90%. These values are based on tests conducted in accordance with ASHRAE Standard 52.1 (37). The increased filtration is based on the use of electrostatic filters with an ASHRAE dust spot efficiency of 30% and an arrestance of 95%.

Although the efficiencies of particulate filters change over time as they become loaded, the computer simulations in this project will employ a constant filter efficiency. The efficiencies of the baseline and improved filters used in the simulations will be as follows:

	Baseline	Control #1
Particles <2.5 μm in diameter	5%	30%
Particles between 2.5 and 10 μm in diameter	90%	95%

The improved filters are installed in place of the regular furnace filters. Their location is indicated in the revised duct drawings showing all of the IAQ control technologies, Figures 13 through 16.

The installation of the improved filters are assumed not to affect the thermal loads of the houses. Due to a higher pressure drop through the filters, they may cause a slight reduction in the airflow rate through the system, which could affect the pressures across the building envelope and the resultant building infiltration rates. However, this effect is expected to be small, and the thermal load calculations were not modified for this control technology.

The cost of this first control technology includes the cost of the filters themselves and their installation. For comparison, the furnace filters in the baseline houses are assumed to cost $2 each and to be changed every month. Therefore, the annual cost of the baseline filters is $24. The improved filters are assumed to cost $15 each and to be changed every 2 months. Therefore, the annual cost of the improved filters is $90.

The installation of improved filters will reduce the concentrations of the so-called “other contaminants” in the houses to the degree that the filtration of each contaminant is increased. The concentrations of particulate contaminants with outdoor sources (pollen) will be reduced due to the increased particulate filtration. The concentrations of VOCs associated with outdoor odors will not be decreased. The increased filtration will not affect indoor ozone levels due to outdoor sources, since ozone removal rates will be unaffected by the new filters. In addition, these electrostatic filters are not sources of ozone themselves. The concentrations of other contaminants with indoor sources will also be affected to the degree that the filtration of each contaminant is increased. The levels of cooking odors and tobacco smoke will be decreased based on the increased filter efficiency for both fine and coarse particulates. Indoor moisture levels will be unaffected by the new filters because the outdoor air change rates will not be affected and because the improved filters have no humidification or dehumidification impacts.

Electronic air cleaners are also of interest and may be investigated in follow-up work. The existence of reliable performance data is being investigated.

Heat Recovery Ventilator

The second IAQ control technology is the installation of a heat recovery ventilator (HRV) in conjunction with the forced-air distribution system. As seen in Figure 11, the device brings outdoor air into the building where it exchanges heat with an airstream leaving the return side of the forced air system. Under heating conditions, the outdoor air is warmed by the outgoing airstream, and under cooling the outdoor air is cooled. The outgoing airstream is exhausted to the outdoors after leaving the heat recovery ventilator. The airstream from outdoors flows into the return side of the forced-air system after leaving the HRV.

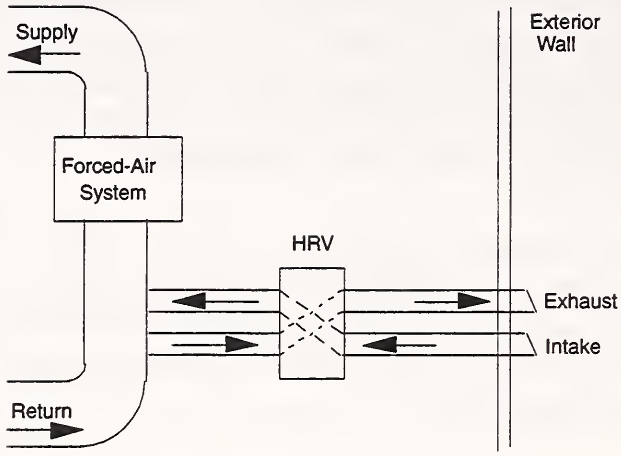

Figure 11 - Schematic of Heat Recovery Ventilator

The HRV specifications are based on a commercially-available model designed for residential use and installation in conjunction with forced-air systems. The airflow rate capacity of the device was selected to obtain an air change rate of at least 0.5 air changes per hour (ach) at full flow. The actual outdoor airflow rate during operation was selected to provide 0.35 ach through the HRV. The actual whole building air change rate will also include envelope infiltration, which in turn depends on the airtightness of the house, weather conditions and ventilation equipment operation. The HRV specifications for the four houses are as follows:

Miami, 2-story
- Airflow capacity: 30 to 60 L/s (65 to 127 cfm), roughly 0.25 to 0.5 ach
- Airflow rate during operation: 44 L/s (93 cfm)
- Efficiency: 69% at 0 °C (32 °F), 60% at -25 °C (-13 °F)
- Maximum power consumption: 115 W
- No defrost

Miami, Ranch
- Airflow capacity: 30 to 60 L/s (65 to 127 cfm), roughly 0.4 to 0.8 ach
- Airflow rate during operation: 26 L/s (55 cfm)
- Efficiency: 69% at 0 °C (32 °F), 60% at -25 °C (-13 °F)
- Maximum power consumption: 115 W
- No defrost

Minneapolis, 2-story
- Airflow capacity: 55 to 95 L/s (115 to 200 cfm), roughly 0.3 to 0.5 ach
- Airflow rate during operation: 66 L/s (140 cfm)
- Efficiency: 68% at 0 °C (32 °F), 61% at -25 °C (-13 °F)
- Maximum power consumption: 216 W
- Defrost cycle

Minneapolis, Ranch

Airflow capacity: 30 to 70 L/s (65 to 150 cfm), roughly 0.2 to 0.5 ach
Airflow rate during operation: 52 L/s (110 cfm)
Efficiency: 76% at 0 °C (32 °F), 56% at -25 °C (-13 °F)
Maximum power consumption: 105 W
Defrost cycle

The defrost cycle involves closing the outdoor air dampers for 5 minutes when the outdoor temperature is below -5 °C (23 °F). For outdoor temperatures between -5 and -30 °C (23 and -22 °F), each 5-minute defrost cycle is followed by a 35 minute period of air exchange before the next defrost cycle. For outdoor temperatures below -30 °C (-22 °F), each 5-minute defrost cycle is followed by 20 minutes of air exchange.

The HRV can be operated in several different control modes. The operation of the device and the fan speed (high or low) can be controlled by a timer, manually by the occupant or by a dehumidistat.

The installation of the HRV in each of the four houses is indicated in the revised duct drawings in Figures 13 through 16.

The thermal loads of the houses are affected by the installation and operation of the HRV due to the increased outdoor air change rate of the house when the devices are in operation. The air change rate due to the HRV operation is assumed to be additive to the baseline infiltration rate of 0.75 ach assumed for the design thermal load calculations. The thermal loads are increased by only a fraction of the increased outdoor air change rate based on the heat exchange efficiencies of the devices. For an additional air change rate of 0.35 ach and the rated heat exchange efficiencies of the HRVs, the revised design thermal loads for the four houses are given below. The baseline design thermal loads are described in detail in the Phase I report (2).

Miami, 2-story	Baseline	With HRV
Heating	2.87 kW	3.14 kW
Cooling	6.43 kW	6.60 kW
Miami, Ranch	Baseline	With HRV
Heating	1.83 kW	1.99 kW
Cooling	5.76 kW	5.88 kW
Minneapolis, 2-story	Baseline	With HRV
Heating	12.64 kW	13.59 kW
Cooling	6.21 kW	6.36 kW
Minneapolis, Ranch	Baseline	With HRV
Heating	9.25 kW	9.86 kW
Cooling	4.89 kW	4.97 kW

The cost of the HRVs includes the cost of the equipment and installation, the operating costs for the fans in the devices and the increased energy consumption due to the additional outdoor air change of the building. The cost of the equipment is $500 for both of the Miami houses, $600 for the Minneapolis ranch house and $700 for the Minneapolis two-story house. These are list prices from the manufacturer of the HRV on which the specifications are based. The installation costs are more variable, based on the layout of the house and local labor rates, and they can range from $200 to $500. The cost of the energy consumed by the device and by the additional outdoor air change rate requires detailed thermal modeling of the building and system. As discussed in the Phase I report of the project, such modeling is beyond the scope of this project.

The installation of the HRV will impact the so-called "other contaminants" in the houses due to the increased outdoor air change rate. Due to the additional outdoor airflow into the houses, the concentrations of contaminants with outdoor sources (pollen, outdoor odors and ozone) will increase. For a simple, nonreactive and unfiltered contaminant, there will be an increased contaminant load equal to the outdoor concentration multiplied by the outdoor airflow rate. The impact of particulates will be reduced based on the efficiency of the filters in the HRV and of the furnace filter. The impact of outdoor ozone will be reduced somewhat by losses on the interior surfaces of the HRV ductwork. The concentrations of other contaminants with indoor sources (cooking odors and tobacco smoke) will be reduced based on the increased air change rate of the building. The impact of the additional ventilation on moisture will depend on the building location, indoor moisture sources, and season. Indoor humidity levels will be reduced when there are large indoor sources and low relative humidity outdoors, but will be increased when the outdoor humidity is higher than the indoor level. Detailed modeling of moisture transport is required to assess these impacts and is beyond the scope of the current project.

Outdoor Intake Duct

The third IAQ control technology is the installation of an outdoor air intake duct on the return side of the forced air distribution system. As seen in Figure 12, the system consists of an intake, a duct, a motorized damper, and a volume damper for adjusting the airflow rate, and is connected to the return side of the return duct. The maximum airflow rate capacity of the intake is 78 L/s (165 cfm), which corresponds to the following air change rates for the four houses:

Miami, 2-story: 0.62 ach
Miami, Ranch: 1.05 ach
Minneapolis, 2-story: 0.41 ach
Minneapolis, Ranch: 0.53 ach

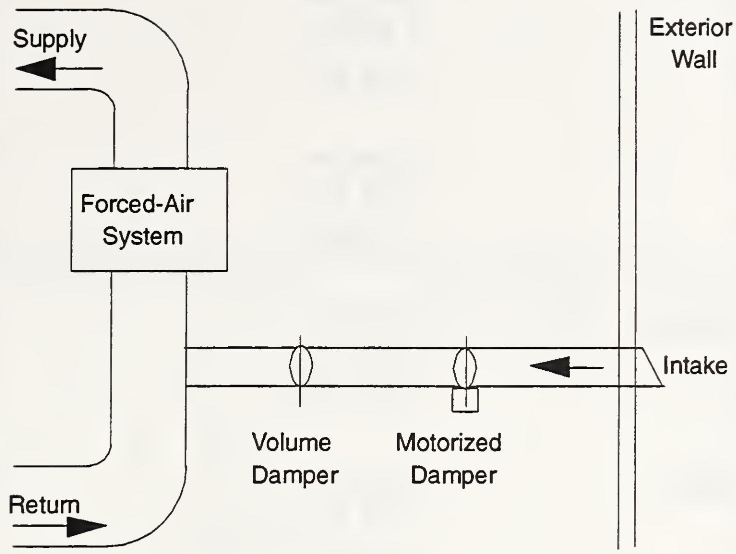

Figure 12 - Schematic of Outdoor Air Intake Duct

The actual airflow rate through the intake depends on the position of the volume damper, the overall airflow resistance of the intake system, and the pressure developed by the forced-air fan. In the computer simulations, it is assumed that the volume damper is adjusted such that the intake system provides 0.35 ach to the building when the furnace fan is in operation. This air change rate corresponds to the following outdoor air intake rates for the four buildings:

Miami, 2-story: 44 L/s (93 cfm)
Miami, Ranch: 26 L/s (55 cfm)
Minneapolis, 2-story: 66 L/s (140 cfm)
Minneapolis, Ranch: 52 L/s (110 cfm)

The motorized damper can be controlled in several different ways. It is generally interlocked with the forced-air system fan so that it opens only when the forced-air fan is operating. The motorized damper can also be controlled to open based on a timer, dehumidistat or pollutant (e.g. carbon monoxide or carbon dioxide) sensor.

The installation of the outdoor air intake duct in each of the four houses is indicated in the revised duct drawings in Figures 13 through 16.

The thermal loads of the houses are affected by the installation and operation of the outdoor air intake duct due to the increased outdoor air change rate of the house when the devices are in operation. The air change rate due to the HRV operation is assumed to be additive to the baseline infiltration rate of 0.75 ach assumed for the design thermal load calculations. Based on an additional air change rate of 0.35 ach and no heat exchange, the design thermal loads for the four houses are given below. The baseline thermal loads were described in detail in the Phase I report (2).

Miami, 2-story	Baseline	With OAID
Heating	2.87 kW	3.54 kW
Cooling	6.43 kW	6.96 kW
Miami, Ranch	Baseline	With OAID
Heating	1.83 kW	2.23 kW
Cooling	5.76 kW	6.09 kW
Minneapolis, 2-story	Baseline	With OAID
Heating	12.64 kW	15.00 kW
Cooling	6.21 kW	6.71 kW
Minneapolis, Ranch	Baseline	With OAID
Heating	9.25 kW	10.73 kW
Cooling	4.89 kW	5.18 kW

The cost of the outdoor air intake duct includes the cost of the equipment and installation and the increased energy consumption due to the additional outdoor air change of the building. The cost of the equipment, including the controls and the motorized dampers, is $750 based on list prices from the manufacturer of the outdoor air intake duct on which the specifications are based. The installation costs are more variable, based on the layout of the house and local labor rates, and they can range from $100 to $300. The cost of the energy consumed by the device and by the additional outdoor air change rate requires detailed thermal modeling of the building and system. As discussed in the Phase I report of the project (2), such modeling is beyond the scope of this project.

The installation of the outdoor air intake duct will impact the so-called "other contaminants" in the houses. Due to the additional outdoor airflow into the houses, the concentrations of contaminants with outdoor sources (pollen, outdoor odors and ozone) will increase. For a simple, nonreactive and unfiltered contaminant, the impact will be an increased contaminant load equal to the outdoor concentration multiplied by the outdoor airflow rate. The impact of particulates will be lessened based on the removal efficiency of the furnace filter. The impact of ozone will be lessened by losses on the interior surfaces of the ductwork. The concentrations of other contaminants with indoor sources (cooking odors and tobacco smoke) will be reduced based on the increased air change rate of the building. As in the case of the HRV, the impact of the additional ventilation on moisture will depend on the building location, indoor moisture sources, and season.

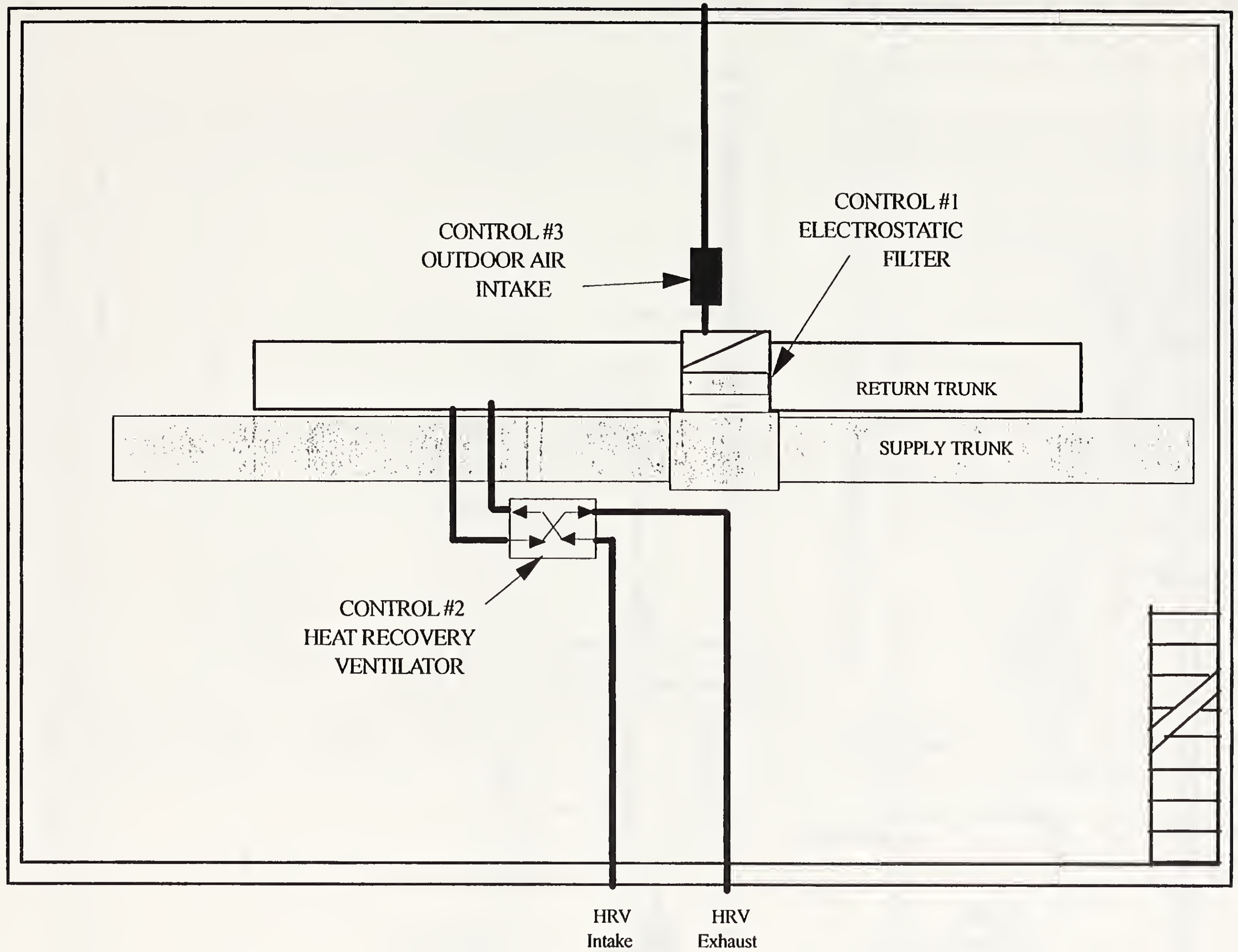

Figure 13 - IAQ Controls for Minneapolis Ranch House

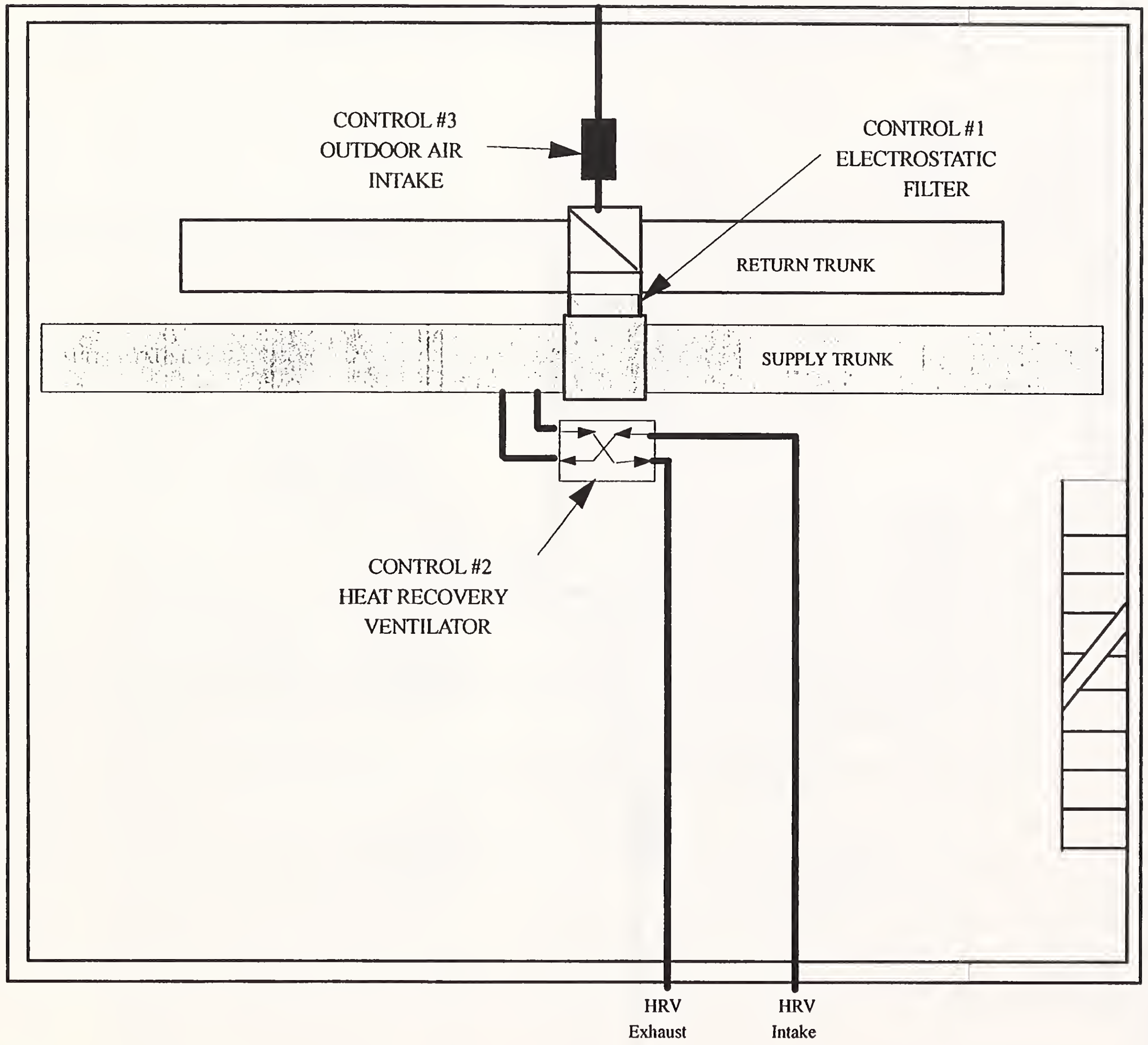

Figure 14 - IAQ Controls for Minneapolis 2-Story House

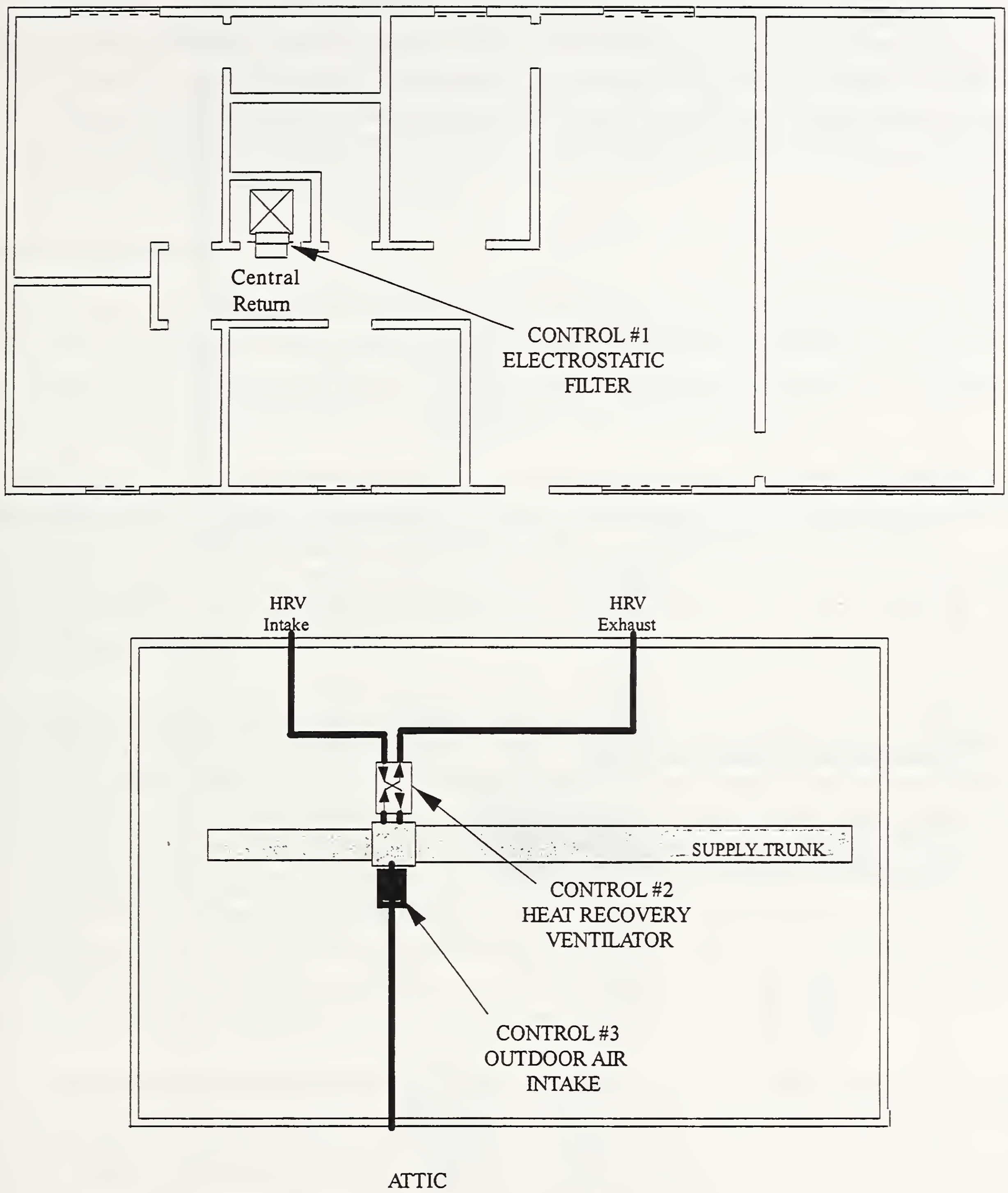

Figure 15 - IAQ Controls for Miami Ranch House

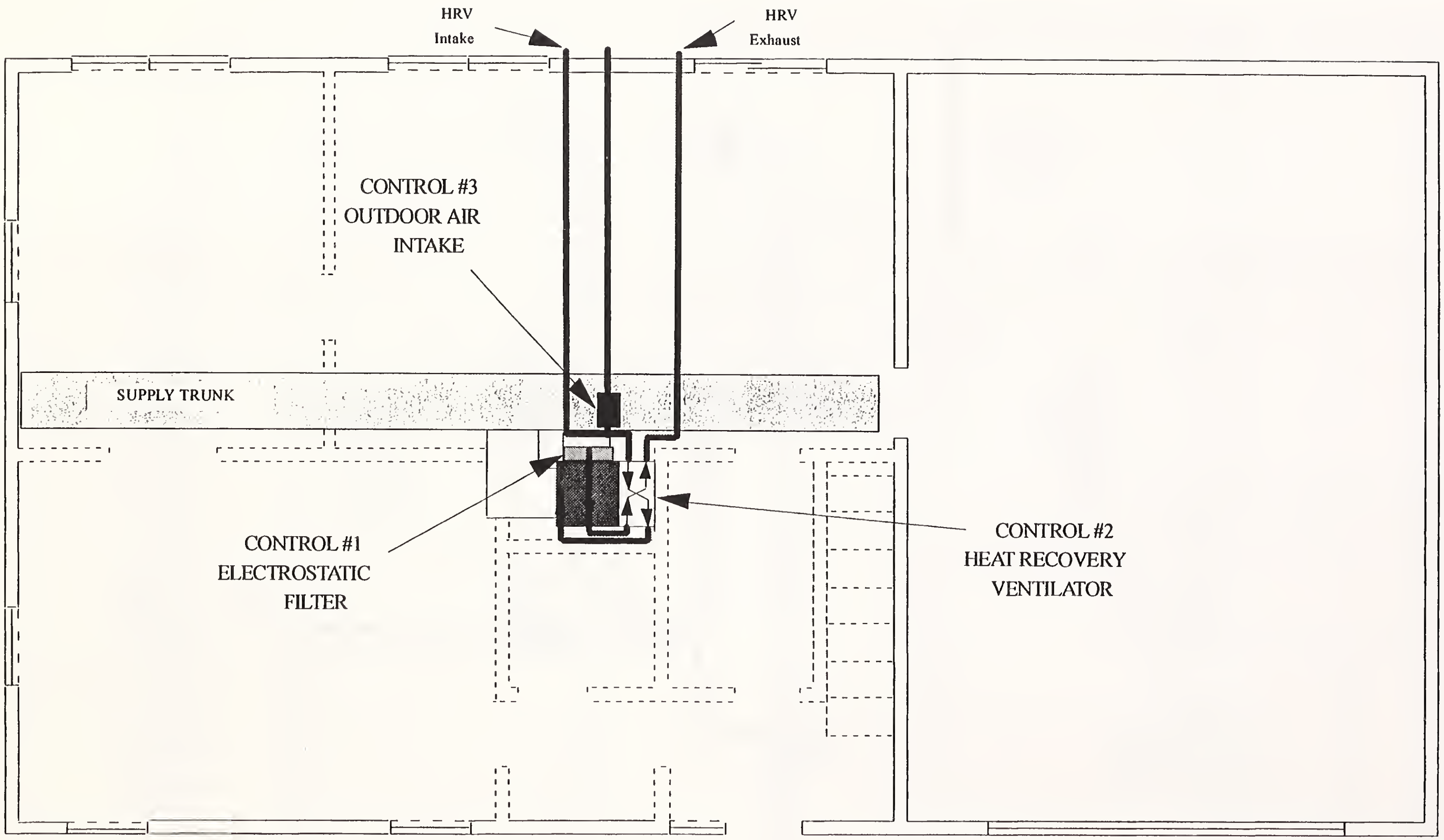

Figure 16 - IAQ controls for Miami 2-Story House

Preliminary Simulation of IAQ Control Retrofits

This section describes the preliminary simulations of the IAQ control retrofits. These simulations involved modifying selected baseline simulation cases with the IAQ control retrofits described above. The preliminary simulations were performed to verify the ability of the program to model the control technologies. In Phase II.B of the study, all of the baseline cases will be modified to incorporate each of the IAQ control retrofits.

IAQ Control Retrofits

The IAQ control retrofits selected for modeling in this study are an electrostatic particulate filter, a heat recovery ventilator, and an outdoor air intake damper installed on the forced-air system return. These three technologies were described in detail in the previous section. This section discusses only the details important to modeling them with CONTAM93 (1).

The electrostatic particulate filters selected for the study have a filter efficiency of 30% for fine particles (emitted by the combustion sources in these simulations) and 95% for coarse particles (associated with the elevated outdoor air concentrations). The filters will be modeled by replacing the standard furnace filters in the baseline HVAC systems with the electrostatic filters. The filter efficiency will be modeled as constant over time and impacts on airflow through the system will be neglected.

The second IAQ control retrofit is the installation of a heat recovery ventilator (HRV) in conjunction with the HVAC system. The HRV draws air from the return side of the forced-air system and replaces it with outdoor air drawn through the heat exchanger. The outdoor airflow rate supplied will be 44 L/s for the Miami 2-story house, 26 L/s for the Miami ranch house, 66 L/s for the Minneapolis 2-story house, and 52 L/s for the Minneapolis ranch house. The HRV will be modeled by setting the outdoor airflow rate for each HVAC system to the appropriate fraction of the total system supply airflow rate. Thus, the desired amount of outdoor air will be supplied whenever the HVAC system is operating. The HVAC systems will be operated on the same schedules determined for the baseline simulations based on thermal loads. Other possible control options (such as constant operation or demand control) will not be studied.

Other considerations in modeling the HRV include filtration of the incoming outdoor air and the HRV defrost cycle. A standard furnace filter (with efficiencies of 5% for fine particles and 90% for coarse particles) will be included in the outdoor air intake path of the HRV. The HRV employs a defrost cycle in cold weather which involves periodically closing the outdoor air damper. However, operation of the defrost cycle will be neglected in the simulations.

The third IAQ control retrofit is the installation of an outdoor air intake duct on the return side of the HVAC system, which draws outdoor air into the return side of the forced-air system whenever it is operating. This retrofit will be modeled similar to the HRV. The baseline HVAC system will be modified to include a constant fraction of outdoor air whenever the HVAC system is operating. The outdoor air supply airflow rates will be the same as listed above for the HRV, and a standard furnace filter will be included in the outdoor air intake path. The primary

difference between the outdoor air intake damper and the HRV is that the outdoor air intake damper does not include an exhaust duct. Therefore, the outdoor airflow will tend to pressurize the house. This effect will be modeled by reducing the HVAC return flows by an amount equal to the outdoor air supplied to the system.

Results of Preliminary Simulation of IAQ Control Retrofits

The baseline case selected for modification with the IAQ control retrofits was SIM1FLC, the Miami ranch house with typical airtightness in cold weather. The simulations with the electrostatic particulate filtration, the HRV, and the outdoor air intake damper are referred to as SIM1FLCF, SIM1FLCH, and SIM1FLCO, respectively.

The results of each simulation includes pollutant concentrations for up to 18 pollutants in each of the building zones for each 15 minute time step of the 24 hour simulation period. As was the case for the baseline simulations, the complete transient simulation results are not presented here but are available in spreadsheet files. Figures 17 through 20 show examples of the transient pollutant concentrations and Tables 25a through 27e of Appendix B present a complete summary of peak and 24-hour, 4-hour, and 1-hour average concentrations for the preliminary IAQ control retrofit simulations as described for the baseline simulations.

Figure 17 shows total volatile organic compound (TVOC) concentrations in Zone LDA resulting from the constant floor source (VOC2 of Tables 1, 26, and 27 of Appendix B) for SIM1FLC, SIM1FLCH, and SIM1FLCO. Since SIM1FLCF differs from SIM1FLC by improved particle filtration efficiency, all VOC concentrations in SIM1FLCF are identical to SIM1FLC and are not shown. Both outdoor air intake devices result in modest reductions in the TVOC concentrations in the zone, with the HRV having a slightly greater effect. The HRV may have a greater effect because it has a neutral effect on indoor pressure (compared to the outdoor air intake damper which pressurizes the building) resulting in a greater average air change rate. The 24-hour average TVOC concentration in Zone LDA is 6040 $\mu g/m^3$, 5545 $\mu g/m^3$, and 5720 $\mu g/m^3$ for SIM1FLC, SIM1FLCH, and SIM1FLCO, respectively (see Tables 1c, 26c, and 27c of Appendix B).

Figure 18 shows TVOC concentrations in Zone LDA resulting from a burst VOC source in the garage (VOC5 of Tables 1, 26, and 27 of Appendix B). The VOC concentrations for SIM1FLC and SIM1FLCH are nearly identical while the concentrations for SIM1FLCO are somewhat lower. The 24 hour average TVOC concentration in Zone LDA for this source is 141 $\mu g/m^3$, 140 $\mu g/m^3$, and 132 $\mu g/m^3$ for SIM1FLC, SIM1FLCH, and SIM1FLCO, respectively (see Tables 1c, 26c, and 27c of Appendix B). The slightly reduced concentrations for SIM1FLCO is due to the effect of the outdoor air pressurizing the interior of the house which reduces the transport of the contaminant from the garage.

Figure 19 shows fine particle concentrations in the kitchen resulting from the oven source (PART.1 of Tables 1, 25, 26, and 27 of Appendix B). The improved filtration in case SIM1FLCF resulted in lower concentrations while the outdoor air intake devices had very little impact, possibly because the outdoor air particle concentration of 13 $\mu g/m^3$ is close to the 24 hour

average baseline concentration. The 24 hour average fine particle concentration in Zone KIT is 11.4 $\mu g/m^3$, 9.8 $\mu g/m^3$, 11.6 $\mu g/m^3$, and 11.6 $\mu g/m^3$ for SIM1FLC, SIM1FLCF, SIM1FLCH, and SIM1FLCO, respectively (see Tables 1c, 25c, 26c, and 27c of Appendix B).

Figure 20 shows coarse particle concentrations in Zone LDA resulting from elevated outdoor levels (PART.3 of Tables 1, 25, 26, and 27 of Appendix B). None of the IAQ control retrofits resulted in a significant impact on the coarse particle concentrations. The 24 hour average coarse particle concentration in Zone LDA is 13.7 $\mu g/m^3$, 13.6 $\mu g/m^3$, 13.8 $\mu g/m^3$, and 13.5 $\mu g/m^3$ for SIM1FLC, SIM1FLCF, SIM1FLCH, and SIM1FLCO, respectively (see Tables 1c, 25c, 26c, and 27c of Appendix B). Possible explanations for the small changes include the relatively small increase in filtration efficiency for the electrostatic particulate filter (from 90% to 95%) and the inclusion of a standard filter in the outdoor air intake path for both the HRV and the outdoor air intake damper. The outdoor air intake filter limits the number of particles brought in with the outdoor air.

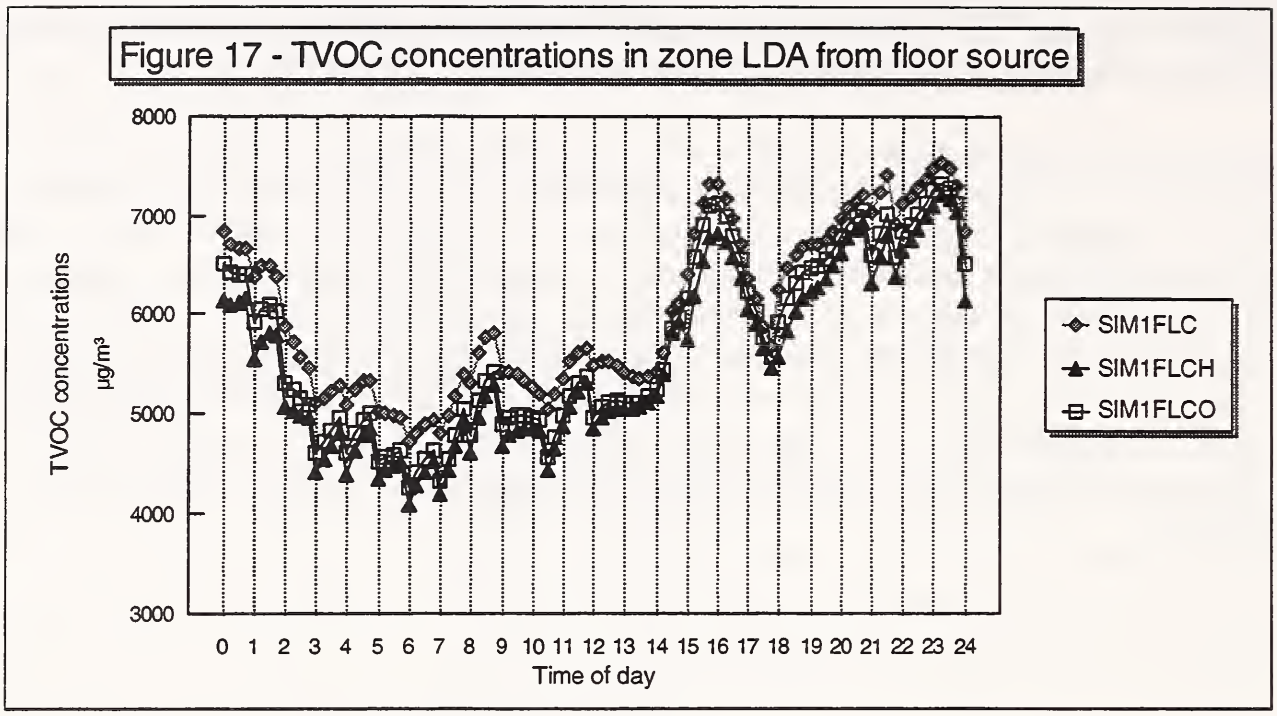
Figure 17 - TVOC concentrations in zone LDA from floor source
8000
7000
6000
5000
4000
3000
TVOC concentrations
µg/m³
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Time of day
SIM1FLC
SIM1FLCH
SIM1FLCO

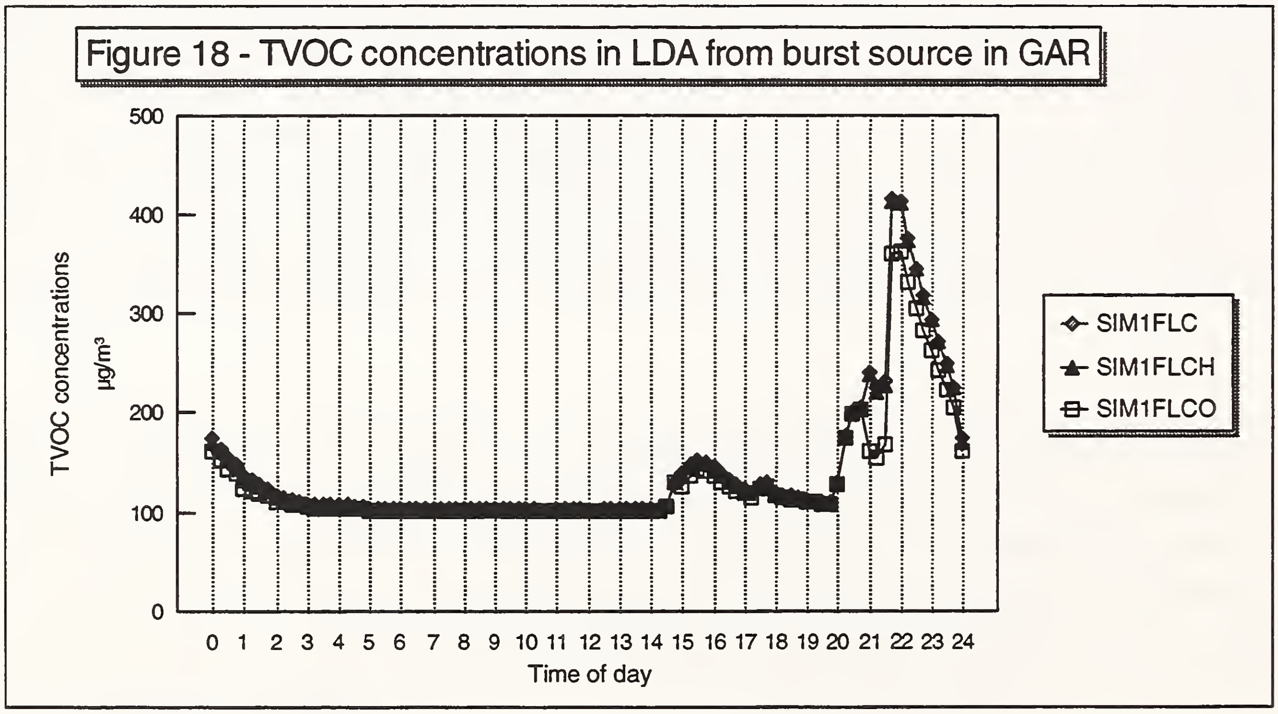
Figure 18 - TVOC concentrations in LDA from burst source in GAR
500
400
300
200
100
0
TVOC concentrations
µg/m³
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Time of day
SIM1FLC
SIM1FLCH
SIM1FLCO

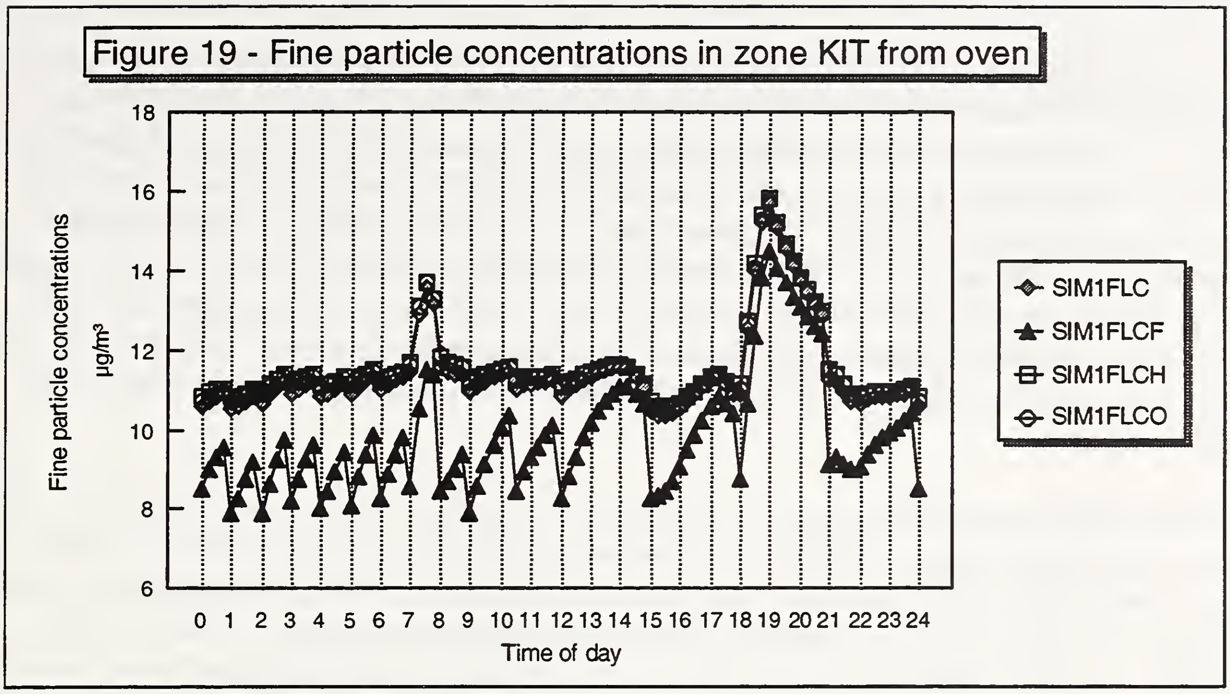
Figure 19 - Fine particle concentrations in zone KIT from oven
Fine particle concentrations
µg/m³
18
16
14
12
10
8
6
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Time of day
SIM1FLC
SIM1FLCF
SIM1FLCH
SIM1FLCO

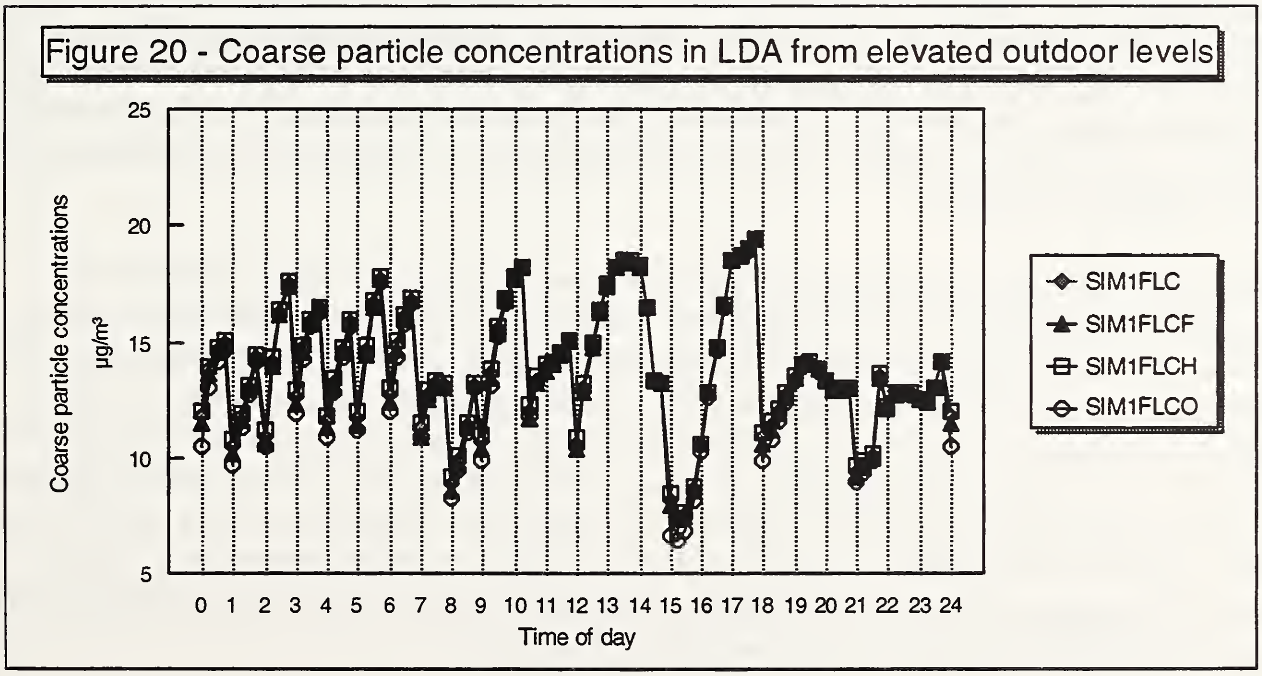
Figure 20 - Coarse particle concentrations in LDA from elevated outdoor levels
Coarse particle concentrations
µg/m³
25
20
15
10
5
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Time of day
SIM1FLC
SIM1FLCF
SIM1FLCH
SIM1FLCO

Summary

The National Institute of Standards and Technology (NIST) has completed Phase II.A of a project for the U.S. Consumer Product Safety Commission (CPSC) to study the impact of HVAC systems on residential indoor air quality and to assess the potential for using residential forced-air systems to control indoor pollutant levels. In this effort, NIST is performing whole building airflow and contaminant dispersal computer simulations with the program CONTAM93 to assess the ability of modifications of central forced-air heating and cooling systems to control pollutant sources relevant to the residential environment. During Phase II.A of this project, three major efforts were completed: baseline simulations of contaminant levels without IAQ controls, design of the IAQ control retrofits, and preliminary simulations of contaminant levels with the IAQ control retrofits.

It is important to note that the project is essentially a scoping study to conduct a preliminary assessment, using computer simulation, of the potential for using forced-air HVAC systems to improve residential IAQ. The project results are also limited by the lack of high quality input data for some simulation inputs and the lack of a thorough empirical evaluation of the model's predictive capability. Despite these limitations, the project is expected to identify key issues for further analysis and experimental work to meet the overall goal of cost-effective IAQ control in residential buildings.

This report described the input data used to model the baseline houses with CONTAM93 including the configuration of the building zones, the air leakage of the building envelopes and of interior partitions, wind pressure profile on the building envelope, pollutant source strengths and temporal profiles, heating and cooling system flows, furnace filter efficiency, pollutant sinks, pollutant decay or deposition, and ambient weather and pollutant concentrations. The results of the baseline simulations including transient pollutant concentrations for selected simulations and a summary of peak and average concentrations for all baseline simulations were also presented. It should be noted that the results for any one simulation may be counter-intuitive and should not be generalized to all cases.

Three indoor air quality control technologies were then selected for incorporation into the baseline house models to determine their effectiveness in controlling the modeled pollutant sources. The technologies selected include the following: an electrostatic particulate filter with efficiencies of 30% for fine particles and 95% for coarse particles, a heat recovery ventilator (HRV) providing an actual outdoor airflow of 0.35 ach, and an outdoor air intake damper on the forced-air system return also providing an actual outdoor airflow of 0.35 ach. The annual cost of the filters was estimated at $90. The estimated installation and equipment costs of the HRV and of the outdoor air intake duct were $700 to $1200 and $850 to $1050, respectively. Detailed thermal modeling of the building and system would be required to determine the annual energy costs of these devices and is beyond the scope of this project.

Selected baseline cases were then modified to implement these IAQ control retrofits and preliminary simulations were performed to verify the ability of the program to model the control technologies. The results for the IAQ control retrofits are presented as examples only and are not

intended to be used to evaluate the effectiveness of the controls. In Phase II.B of the study, all of the baseline cases will be modified to incorporate each of the IAQ control retrofits. The Phase II.B simulation results will be compared to the baseline simulation results to determine the effectiveness of the IAQ control technologies at reducing contaminant levels in single-family residential buildings.

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Appendix A Airflow Modeling Results

CONTAM93 was used to analyze airflow in the houses using two approaches: simulated fan pressurization tests and directly calculated whole building air change rates under a range of wind speed and indoor - outdoor temperature differences.

Fan pressurization tests in the houses were simulated with CONTAM93 by including a constant flow element in the door of each house and adjusting the flow until a pressure differences of 4 and 50 Pa was achieved. The airflow rates at 50 Pa were divided by the interior volumes of the houses to determine the 50 Pa air change rates, and the 4 Pa flows were converted to effective leakage areas using Equation 27 in Chapter 23 of ASHRAE (3). The results of the fan pressurization simulations are shown in Table 1. The difference between the Miami and Minneapolis houses is due primarily to the existence of the basement in the Minneapolis houses. In terms of both measures of airtightness, the tight houses are about 66% tighter than the houses of typical leakage.

Table 1 - Fan pressurization simulation results

House	ach_{50} (hr^{-1})	Leakage area (cm^2)
Typical Miami ranch	13.2	680
Tight Miami ranch	4.1	220
Typical Minneapolis ranch	6.6	720
Tight Minneapolis ranch	2.2	230
Typical Miami 2 story	12.9	1,120
Tight Miami 2 story	4.6	390
Typical Minneapolis 2 story	8.8	1,170
Tight Minneapolis 2 story	3.1	410

CONTAM93 was used to calculate whole building air change rates for wind speeds from 0 to 10 m/s and indoor-outdoor temperature differences from -10 to 30 °C. The wind direction was held constant throughout the simulations. These simulations were performed with the HVAC systems both on and off. Whole building air change rates were calculated by adding the airflow entering the conditioned space of the house through all leakage paths. The results of these airflow simulations are shown in Tables 2 through 9 for the system off.

Several general trends are shown by these tables. Using 'tight' values for the airflow elements vs. 'typical' or best estimate values reduced the whole building air change rate by up to a factor of four as compared to a factor of three for the fan pressurization results. Also, over the range considered here, the wind speed had a much greater impact on the whole building air change rate than the temperature difference. However, the tight airflow elements reduced the impact of the wind speed more than the impact of the temperature difference.

Table 2 - Whole house air change rate for typical Miami ranch house (ach)

Tin - Tout (K)	-10	-5	0	5	10	15	20	25	30
Wind speed (m/s)									
0	0.33	0.21	0.00	0.22	0.35	0.46	0.57	0.67	0.76
2	0.40	0.32	0.33	0.38	0.47	0.54	0.65	0.74	0.84
4	0.75	0.78	0.82	0.85	0.89	0.94	1.00	1.08	1.15
6	1.31	1.34	1.38	1.42	1.46	1.50	1.54	1.61	1.67
8	1.92	1.96	2.01	2.06	2.11	2.16	2.21	2.27	2.33
10	2.57	2.63	2.69	2.75	2.81	2.87	2.94	3.01	3.08

Table 3 - Whole house air change rate for tight Miami ranch house (ach)

Tin - Tout (K)	-10	-5	0	5	10	15	20	25	30
Wind speed (m/s)									
0	0.10	0.07	0.00	0.07	0.11	0.14	0.17	0.20	0.23
2	0.11	0.09	0.08	0.10	0.14	0.17	0.20	0.23	0.26
4	0.18	0.18	0.19	0.21	0.22	0.24	0.26	0.28	0.31
6	0.30	0.31	0.32	0.33	0.34	0.36	0.38	0.39	0.42
8	0.44	0.46	0.47	0.48	0.49	0.51	0.53	0.54	0.57
10	0.60	0.61	0.63	0.64	0.65	0.67	0.69	0.71	0.73

Table 4 - Whole house air change rate for typical Minneapolis ranch house (ach)

Tin - Tout (K)	-10	-5	0	5	10	15	20	25	30
Wind speed (m/s)									
0	0.25	0.16	0.00	0.16	0.26	0.34	0.42	0.49	0.56
2	0.29	0.23	0.18	0.23	0.31	0.39	0.46	0.53	0.59
4	0.45	0.41	0.44	0.47	0.50	0.54	0.59	0.64	0.69
6	0.69	0.72	0.75	0.78	0.81	0.83	0.87	0.91	0.95
8	1.03	1.06	1.09	1.12	1.16	1.19	1.22	1.26	1.29
10	1.39	1.43	1.46	1.50	1.54	1.57	1.62	1.66	1.70

Table 5 - Whole house air change rate for tight Minneapolis ranch house (ach)

Tin - Tout (K)	-10	-5	0	5	10	15	20	25	30
Wind speed (m/s)									
0	0.09	0.06	0.00	0.06	0.10	0.13	0.16	0.19	0.21
2	0.09	0.07	0.04	0.07	0.11	0.14	0.17	0.20	0.22
4	0.13	0.10	0.11	0.12	0.14	0.16	0.19	0.21	0.24
6	0.17	0.18	0.19	0.19	0.21	0.22	0.23	0.25	0.27
8	0.25	0.26	0.27	0.28	0.29	0.30	0.31	0.33	0.34
10	0.34	0.35	0.36	0.37	0.38	0.39	0.41	0.42	0.44

Table 6 - Whole house air change rate for typical Miami 2 story house (ach)

Tin - Tout (K)	-10	-5	0	5	10	15	20	25	30
Wind speed (m/s)									
0	0.38	0.24	0.00	0.25	0.40	0.53	0.64	0.76	0.87
2	0.44	0.34	0.36	0.42	0.51	0.62	0.72	0.81	0.91
4	0.82	0.86	0.89	0.93	0.96	1.02	1.08	1.15	1.21
6	1.43	1.47	1.51	1.55	1.60	1.64	1.68	1.74	1.80
8	2.10	2.15	2.20	2.25	2.30	2.36	2.41	2.47	2.53
10	2.82	2.88	2.94	3.01	3.07	3.14	3.21	3.28	3.35

Table 7 - Whole house air change rate for tight Miami 2 story house (ach)

Tin - Tout (K)	-10	-5	0	5	10	15	20	25	30
Wind speed (m/s)									
0	0.13	0.08	0.00	0.09	0.14	0.18	0.22	0.26	0.30
2	0.14	0.10	0.09	0.12	0.16	0.21	0.25	0.28	0.32
4	0.20	0.22	0.23	0.24	0.26	0.28	0.30	0.34	0.38
6	0.36	0.37	0.38	0.40	0.41	0.43	0.44	0.47	0.49
8	0.53	0.54	0.56	0.57	0.59	0.60	0.62	0.64	0.66
10	0.71	0.73	0.75	0.76	0.78	0.80	0.82	0.84	0.86

Table 8 - Whole house air change rate for typical Minneapolis 2 story house (ach)

Tin - Tout (K)	-10	-5	0	5	10	15	20	25	30
Wind speed (m/s)									
0	0.25	0.15	0.00	0.17	0.27	0.35	0.43	0.50	0.58
2	0.30	0.24	0.25	0.28	0.34	0.42	0.48	0.54	0.61
4	0.57	0.60	0.62	0.64	0.66	0.70	0.74	0.78	0.83
6	0.99	1.02	1.05	1.08	1.10	1.13	1.16	1.20	1.24
8	1.46	1.49	1.52	1.56	1.60	1.63	1.67	1.71	1.75
10	1.95	2.00	2.04	2.08	2.12	2.17	2.22	2.27	2.32

Table 9 - Whole house air change rate for tight Minneapolis 2 story house (ach)

Tin - Tout (K)	-10	-5	0	5	10	15	20	25	30
Wind speed (m/s)									
0	0.09	0.06	0.00	0.06	0.09	0.12	0.15	0.18	0.20
2	0.10	0.07	0.06	0.08	0.11	0.14	0.17	0.19	0.21
4	0.14	0.15	0.16	0.17	0.18	0.19	0.21	0.23	0.26
6	0.25	0.26	0.27	0.28	0.29	0.30	0.31	0.33	0.34
8	0.37	0.38	0.39	0.40	0.41	0.42	0.44	0.45	0.47
10	0.50	0.51	0.53	0.54	0.55	0.56	0.58	0.59	0.61

Tables 10 through 17 present the results of the airflow simulations with the HVAC system on. Operation of the HVAC system increased the building air change rate as much as 0.31 ach at zero wind speed and temperature difference due to supply duct leakage in the attic. The effect of the system fan was less than 0.07 ach at high wind speeds (> 4 m/s) and temperature differences (> 10 °C).

Table 10 - Whole house air change rate for typical Miami ranch house with system on (ach)

Tin - Tout (K)	-10	-5	0	5	10	15	20	25	30
Wind speed (m/s)									
0	0.45	0.38	0.31	0.39	0.52	0.63	0.73	0.83	0.93
2	0.59	0.52	0.41	0.50	0.63	0.74	0.84	0.93	1.03
4	0.86	0.81	0.85	0.89	0.95	1.02	1.10	1.17	1.24
6	1.34	1.37	1.41	1.45	1.49	1.55	1.61	1.67	1.73
8	1.95	1.99	2.04	2.09	2.14	2.19	2.25	2.30	2.38
10	2.60	2.66	2.72	2.78	2.84	2.91	2.97	3.04	3.11

Table 11 - Whole house air change rate for tight Miami ranch house with system on (ach)

Tin - Tout (K)	-10	-5	0	5	10	15	20	25	30
Wind speed (m/s)									
0	0.29	0.29	0.30	0.30	0.30	0.31	0.31	0.33	0.37
2	0.30	0.30	0.30	0.30	0.30	0.31	0.32	0.36	0.39
4	0.37	0.36	0.34	0.33	0.31	0.32	0.36	0.41	0.44
6	0.46	0.45	0.44	0.43	0.41	0.40	0.42	0.46	0.49
8	0.56	0.55	0.53	0.52	0.53	0.55	0.57	0.58	0.61
10	0.65	0.64	0.64	0.66	0.69	0.71	0.73	0.75	0.77

Table 12 - Whole house air change rate for typical Minneapolis ranch house with system on (ach)

Tin - Tout (K)	-10	-5	0	5	10	15	20	25	30
Wind speed (m/s)									
0	0.24	0.16	0.00	0.15	0.25	0.33	0.41	0.48	0.55
2	0.28	0.22	0.18	0.22	0.30	0.38	0.45	0.52	0.58
4	0.44	0.41	0.44	0.47	0.50	0.53	0.59	0.64	0.68
6	0.69	0.72	0.75	0.78	0.80	0.83	0.87	0.91	0.94
8	1.03	1.06	1.09	1.12	1.16	1.19	1.22	1.26	1.29
10	1.39	1.42	1.46	1.50	1.53	1.57	1.61	1.65	1.70

Table 13 - Whole house air change rate for tight Minneapolis ranch house with system on (ach)

Tin - Tout (K)	-10	-5	0	5	10	15	20	25	30
Wind speed (m/s)									
0	0.09	0.05	0.00	0.05	0.09	0.12	0.15	0.18	0.21
2	0.08	0.06	0.04	0.06	0.10	0.13	0.16	0.19	0.21
4	0.12	0.10	0.11	0.12	0.13	0.15	0.18	0.21	0.23
6	0.17	0.18	0.18	0.19	0.20	0.22	0.23	0.25	0.26
8	0.25	0.26	0.27	0.28	0.29	0.30	0.31	0.32	0.34
10	0.34	0.35	0.36	0.37	0.38	0.39	0.40	0.42	0.43

Table 14 - Whole house air change rate for typical Miami 2 story house with system on (ach)

Tin - Tout (K)	-10	-5	0	5	10	15	20	25	30
Wind speed (m/s)									
0	0.38	0.24	0.00	0.25	0.40	0.53	0.64	0.76	0.87
2	0.44	0.34	0.36	0.42	0.51	0.62	0.72	0.81	0.91
4	0.82	0.86	0.89	0.93	0.96	1.02	1.08	1.15	1.21
6	1.43	1.47	1.52	1.56	1.60	1.64	1.68	1.74	1.80
8	2.10	2.15	2.20	2.25	2.31	2.36	2.41	2.47	2.53
10	2.82	2.88	2.94	3.00	3.07	3.14	3.21	3.28	3.35

Table 15 - Whole house air change rate for tight Miami 2 story house with system on (ach)

Tin - Tout (K)	-10	-5	0	5	10	15	20	25	30
Wind speed (m/s)									
0	0.13	0.08	0.00	0.09	0.14	0.18	0.22	0.26	0.30
2	0.14	0.10	0.09	0.12	0.16	0.21	0.25	0.28	0.32
4	0.20	0.22	0.23	0.24	0.26	0.27	0.30	0.34	0.38
6	0.36	0.37	0.38	0.39	0.41	0.43	0.44	0.47	0.49
8	0.53	0.54	0.56	0.57	0.59	0.60	0.62	0.64	0.66
10	0.71	0.73	0.75	0.76	0.78	0.80	0.82	0.84	0.87

Table 16 - Whole house air change rate for typical Minneapolis 2 story house with system on (ach)

Tin - Tout (K)	-10	-5	0	5	10	15	20	25	30
Wind speed (m/s)									
0	0.25	0.16	0.01	0.17	0.27	0.35	0.43	0.51	0.58
2	0.31	0.24	0.25	0.29	0.35	0.42	0.48	0.55	0.61
4	0.57	0.60	0.62	0.64	0.66	0.70	0.74	0.79	0.83
6	0.99	1.02	1.05	1.08	1.11	1.13	1.16	1.20	1.24
8	1.46	1.49	1.53	1.56	1.60	1.63	1.67	1.71	1.75
10	1.95	2.00	2.04	2.08	2.13	2.17	2.22	2.27	2.32

Table 17 - Whole house air change rate for tight Minneapolis 2 story house with system on (ach)

Tin - Tout (K)	-10	-5	0	5	10	15	20	25	30
Wind speed (m/s)									
0	0.09	0.06	0.00	0.06	0.09	0.12	0.15	0.18	0.20
2	0.10	0.07	0.06	0.08	0.11	0.14	0.17	0.19	0.21
4	0.15	0.15	0.16	0.17	0.18	0.19	0.21	0.23	0.26
6	0.26	0.26	0.27	0.28	0.29	0.30	0.31	0.33	0.34
8	0.38	0.38	0.39	0.40	0.41	0.42	0.44	0.45	0.47
10	0.50	0.51	0.53	0.54	0.55	0.56	0.58	0.59	0.61

Appendix B Baseline and Preliminary Simulation Results

Tables 1a through 24e of Appendix B summarize the results of all 24 baseline simulations. Tables 25a through 27e summarize the results of the 3 preliminary simulations of the IAQ control retrofits. Tables 1a through 27a show the overall peak concentrations (excluding the basement, attic, garage and closet zones), the location of that overall peak, and the whole house 24-hour average concentrations (excluding the basement, garage, and attic zones). Tables 1b through 27b show the individual zone peak concentrations for the main living space zones. Tables 1c through 27c show the individual zone 24-hour average concentrations. Tables 1d through 27d show the individual zone 4-hour average concentrations. The 4-hour average was calculated for the VOC burst sources from 7 p.m. to 11 p.m., for the oven from 6 p.m. to 10 p.m., and for the heater from 7 am to 11 am. No 4-hour average was calculated for either the floor VOC source or the outdoor air pollutants. Tables 1e through 27e show the individual zone 1-hour average CO concentrations. The 1-hour average was calculated for the oven from 7 p.m. to 8 p.m. and for the heater from 9 am to 10 am.

Table 1a - SIM1FLC overall 24-hr avg concentrations

	VOC1 (μg/m³)	VOC2 (μg/m³)	VOC3 (μg/m³)	VOC4 (μg/m³)	VOC5 (μg/m³)	VOC6 (μg/m³)	VOC7 (μg/m³)	VOC8 (μg/m³)	VOC9 (μg/m³)	CO.1 ppm	NO2.1 ppm	PART.1 (μg/m³)	CO.2 ppm	NO2.2 ppm	PART.2 (μg/m³)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (μg/m³)
24 hr avg	265	6067	218	183	117	225	219	217	205	2.75	0.026	10.86	1.60	0.008	10.75	6.77	0.079	14.63

Table 1b - SIM1FLC zone peak concentrations

	VOC1 (μg/m³)	VOC2 (μg/m³)	VOC3 (μg/m³)	VOC4 (μg/m³)	VOC5 (μg/m³)	VOC6 (μg/m³)	VOC7 (μg/m³)	VOC8 (μg/m³)	VOC9 (μg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (μg/m³)	CO.2 (PPM)	NO2.2 (PPM)	PART.2 (μg/m³)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (μg/m³)
BA2	303	11815	645	232	131	393	347	13163	281	4.93	0.056	10.42	2.25	0.010	10.40	9.48	0.104	8.89
BR2	185	9465	384	197	126	314	271	253	234	4.10	0.047	11.47	2.35	0.017	11.47	9.84	0.165	22.93
BR3	164	10907	672	206	126	347	354	274	4099	4.57	0.046	10.43	2.30	0.011	10.41	9.65	0.107	16.59
HAL	333	7967	1630	303	177	462	596	390	407	5.50	0.083	11.88	2.46	0.017	11.86	10.15	0.166	26.34
KIT	141	7974	297	274	160	4332	255	258	236	44.43	1.434	15.67	2.41	0.014	11.57	10.00	0.140	23.95
LDA	138	7537	337	1593	416	482	258	237	215	6.14	0.089	11.19	2.42	0.013	11.18	10.03	0.132	19.44
MBA	142	6409	293	208	125	312	9360	266	247	3.92	0.054	12.14	2.51	0.019	12.14	10.35	0.191	33.43
MBR	155	6516	2430	178	120	256	752	221	214	3.33	0.045	12.16	2.51	0.021	12.14	10.34	0.210	35.53

Table 1c - SIM1FLC zone 24-hr avg concentrations

	VOC1 (μg/m³)	VOC2 (μg/m³)	VOC3 (μg/m³)	VOC4 (μg/m³)	VOC5 (μg/m³)	VOC6 (μg/m³)	VOC7 (μg/m³)	VOC8 (μg/m³)	VOC9 (μg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (μg/m³)	CO.2 (PPM)	NO2.2 (PPM)	PART.2 (μg/m³)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (μg/m³)
BA2	134	8418	255	138	109	190	200	1915	160	2.38	0.009	9.84	1.61	0.005	9.78	6.80	0.047	3.65
BR2	112	6422	172	124	106	157	155	149	137	2.09	0.010	10.66	1.61	0.007	10.62	6.81	0.075	13.18
BR3	113	8211	252	132	107	178	196	165	727	2.30	0.009	10.01	1.62	0.005	9.96	6.82	0.050	5.27
HAL	123	5249	316	128	108	177	223	155	145	2.32	0.016	11.10	1.60	0.009	11.04	6.77	0.086	16.19
KIT	105	5540	149	133	109	647	142	142	132	6.59	0.124	11.43	1.60	0.008	10.90	6.74	0.084	15.82
LDA	106	6040	162	312	141	206	147	141	131	2.62	0.018	10.84	1.61	0.008	10.75	6.77	0.076	13.73
MBA	104	4130	136	116	103	136	1051	133	125	1.92	0.013	11.41	1.59	0.010	11.38	6.71	0.105	22.41
MBR	107	3982	345	113	103	129	256	127	122	1.85	0.012	11.54	1.59	0.011	11.52	6.72	0.108	24.49

Table 1d - SIM1FLC zone 4-hr avg concentrations

	VOC1 (μg/m³)	VOC2 (μg/m³)	VOC3 (μg/m³)	VOC4 (μg/m³)	VOC5 (μg/m³)	VOC6 (μg/m³)	VOC7 (μg/m³)	VOC8 (μg/m³)	VOC9 (μg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (μg/m³)	CO.2 (PPM)	NO2.2 (PPM)	PART.2 (μg/m³)
BA2	147	NA	449	170	118	276	274	5479	204	3.51	0.015	9.50	1.55	0.007	10.13
BR2	114	NA	289	145	113	209	202	175	167	2.93	0.012	10.23	1.66	0.012	11.12
BR3	114	NA	426	153	114	243	249	190	1958	3.36	0.015	9.75	1.54	0.007	10.20
HAL	138	NA	770	168	126	327	394	200	213	4.21	0.036	10.98	1.65	0.012	11.32
KIT	104	NA	186	181	126	1808	168	170	161	23.65	0.515	13.06	1.60	0.011	10.99
LDA	105	NA	204	768	244	325	164	160	151	5.09	0.046	10.85	1.59	0.010	10.84
MBA	102	NA	181	137	108	174	3126	159	152	2.59	0.013	11.30	1.64	0.013	11.37
MBR	108	NA	922	133	108	164	551	150	152	2.47	0.012	11.33	1.69	0.015	11.75

Table 1e - SIM1FLC zone 1-hr avg concentrations

	CO.1 (PPM)	CO.2 (PPM)
BA2	2.54	1.67
BR2	2.52	1.68
BR3	2.58	1.65
HAL	3.54	1.66
KIT	33.72	1.64
LDA	3.87	1.65
MBA	2.55	1.63
MBR	2.52	1.64

LEGEND

VOC1	Burst - UCL	CO.1	Oven
VOC2	Floor	NO2.1	Oven
VOC3	Burst - MBR	PART.1	Oven
VOC4	Burst - LDA	CO.2	Heater
VOC5	Burst - GAR	NO2.2	Heater
VOC6	Burst - KIT	PART.2	Heater
VOC7	Burst - MBA	CO.3	Outdoor air
VOC8	Burst - BA2	NO2.3	Outdoor air
VOC9	Burst - BR3	PART.3	Outdoor air

Table 2a - SIM1FLM overall 24-hr avg concentrations

	VOC1 (µg/m³)	VOC2 (µg/m³)	VOC3 (µg/m³)	VOC4 (µg/m³)	VOC5 (µg/m³)	VOC6 (µg/m³)	VOC7 (µg/m³)	VOC8 (µg/m³)	VOC9 (µg/m³)	CO.1 ppm	NO2.1 ppm	PART.1 (µg/m³)	CO.3 ppm	NO2.3 ppm	PART.3 (µg/m³)
24 hr avg	235	4899	165	152	98	206	189	218	183	2.50	0.025	11.41	6.68	0.086	18.45

Table 2b - SIM1FLM zone peak concentrations

	VOC1 (µg/m³)	VOC2 (µg/m³)	VOC3 (µg/m³)	VOC4 (µg/m³)	VOC5 (µg/m³)	VOC6 (µg/m³)	VOC7 (µg/m³)	VOC8 (µg/m³)	VOC9 (µg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (µg/m³)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (µg/m³)
BA2	800	9379	137	117	99	160	148	9702	134	2.72	0.022	12.12	11.12	0.177	29.63
BR2	507	7813	337	114	99	260	270	647	127	2.78	0.021	11.89	10.54	0.143	27.41
BR3	325	9145	231	113	99	193	198	403	3875	2.54	0.021	11.69	10.20	0.124	22.57
HAL	1408	6876	672	160	101	455	442	2077	197	3.53	0.053	12.29	11.02	0.198	35.18
KIT	276	7162	122	129	101	3953	139	350	127	40.62	1.386	15.94	10.28	0.152	30.25
LDA	291	7014	165	1400	108	477	147	369	121	6.04	0.106	12.03	10.38	0.139	25.94
MBA	147	5037	126	115	99	151	8783	149	129	2.74	0.022	12.45	11.17	0.204	39.74
MBR	437	6980	2508	110	99	140	1232	321	123	2.52	0.021	12.28	10.42	0.201	34.94

Table 2c - SIM1FLM zone 24-hr avg concentrations

	VOC1 (µg/m³)	VOC2 (µg/m³)	VOC3 (µg/m³)	VOC4 (µg/m³)	VOC5 (µg/m³)	VOC6 (µg/m³)	VOC7 (µg/m³)	VOC8 (µg/m³)	VOC9 (µg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (µg/m³)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (µg/m³)
BA2	302	5128	109	100	98	111	112	1283	104	1.67	0.009	11.18	6.61	0.081	16.87
BR2	208	5523	130	100	98	126	131	228	107	1.72	0.008	11.12	6.74	0.077	15.28
BR3	146	6366	124	100	98	122	125	151	737	1.72	0.007	10.85	6.72	0.066	12.77
HAL	330	3811	148	101	98	138	148	373	117	1.76	0.013	11.70	6.61	0.105	24.06
KIT	140	4728	102	101	98	689	104	153	105	6.77	0.125	11.92	6.66	0.089	19.02
LDA	157	4874	108	269	99	202	109	172	105	2.50	0.019	11.42	6.66	0.085	18.28
MBA	103	3127	101	99	98	103	1070	104	101	1.61	0.012	11.88	6.65	0.114	26.70
MBR	179	4115	406	99	98	104	292	142	104	1.64	0.010	11.59	6.71	0.098	21.74

Table 2d - SIM1FLM zone 4-hr avg concentrations

	VOC1 (µg/m³)	VOC2 (µg/m³)	VOC3 (µg/m³)	VOC4 (µg/m³)	VOC5 (µg/m³)	VOC6 (µg/m³)	VOC7 (µg/m³)	VOC8 (µg/m³)	VOC9 (µg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (µg/m³)
BA2	581	NA	99	98	98	100	100	3284	99	2.01	0.012	11.95
BR2	293	NA	105	98	98	104	105	358	113	2.20	0.011	11.48
BR3	112	NA	104	98	98	103	104	112	2074	2.13	0.009	11.21
HAL	842	NA	104	98	98	103	104	1058	160	2.09	0.018	12.12
KIT	241	NA	100	99	98	1835	100	294	109	21.12	0.466	13.49
LDA	255	NA	101	631	98	330	101	311	110	4.93	0.052	11.73
MBA	99	NA	99	98	98	99	3306	99	99	2.03	0.012	11.93
MBR	370	NA	1131	98	98	100	489	271	108	2.10	0.009	11.43

Table 2e - SIM1FLM zone 1-hr avg concentrations

	CO.1 (PPM)
BA2	2.61
BR2	2.70
BR3	2.49
HAL	3.10
KIT	32.42
LDA	4.42
MBA	2.63
MBR	2.48

LEGEND

VOC1	Burst - UCL	CO.1	Oven
VOC2	Floor	NO2.1	Oven
VOC3	Burst - MBR	PART.1	Oven
VOC4	Burst - LDA	CO.2	Heater
VOC5	Burst - GAR	NO2.2	Heater
VOC6	Burst - KIT	PART.2	Heater
VOC7	Burst - MBA	CO.3	Outdoor air
VOC8	Burst - BA2	NO2.3	Outdoor air
VOC9	Burst - BR3	PART.3	Outdoor air

Table 3a - SIM1FLH overall 24-hr avg concentrations

	VOC1 (μg/m³)	VOC2 (μg/m³)	VOC3 (μg/m³)	VOC4 (μg/m³)	VOC5 (μg/m³)	VOC6 (μg/m³)	VOC7 (μg/m³)	VOC8 (μg/m³)	VOC9 (μg/m³)	CO.1 ppm	NO2.1 ppm	PART.1 (μg/m³)	CO.3 ppm	NO2.3 ppm	PART.3 (μg/m³)
24 hr avg	319	6289	195	199	191	196	201	198	198	2.54	0.023	8.93	6.97	0.078	7.52

Table 3b - SIM1FLH zone peak concentrations

	VOC1 (μg/m³)	VOC2 (μg/m³)	VOC3 (μg/m³)	VOC4 (μg/m³)	VOC5 (μg/m³)	VOC6 (μg/m³)	VOC7 (μg/m³)	VOC8 (μg/m³)	VOC9 (μg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (μg/m³)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (μg/m³)
BA2	453	9689	494	466	292	534	470	7594	522	6.94	0.157	9.71	10.59	0.153	11.05
BR2	293	8185	466	449	269	500	456	506	459	6.64	0.142	10.24	10.61	0.162	15.21
BR3	295	8101	469	452	271	505	459	508	2923	6.69	0.145	10.35	10.65	0.167	16.14
HAL	574	8797	567	546	336	598	529	774	599	7.73	0.190	10.14	10.59	0.157	15.70
KIT	295	9684	462	581	338	2923	450	516	489	24.57	0.932	11.81	10.59	0.149	7.45
LDA	286	8157	439	1327	498	477	429	465	453	6.35	0.133	10.49	10.65	0.164	17.28
MBA	295	9804	485	464	291	524	6599	540	512	6.70	0.149	9.68	10.58	0.151	10.81
MBR	315	9722	2037	438	282	469	1062	483	469	6.32	0.132	9.81	10.53	0.140	12.49

Table 3c - SIM1FLH zone 24-hr avg concentrations

	VOC1 (μg/m³)	VOC2 (μg/m³)	VOC3 (μg/m³)	VOC4 (μg/m³)	VOC5 (μg/m³)	VOC6 (μg/m³)	VOC7 (μg/m³)	VOC8 (μg/m³)	VOC9 (μg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (μg/m³)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (μg/m³)
BA2	232	6505	190	190	185	194	189	430	193	2.51	0.020	8.59	6.97	0.074	3.99
BR2	186	5918	183	183	174	186	181	188	185	2.44	0.020	9.08	6.97	0.084	9.40
BR3	187	5997	184	184	175	188	183	189	284	2.46	0.020	9.01	6.97	0.083	8.81
HAL	213	6197	196	194	188	198	193	203	198	2.53	0.022	8.94	6.96	0.079	7.64
KIT	194	6570	189	199	195	274	188	195	192	3.31	0.054	8.74	6.97	0.072	4.40
LDA	184	5976	181	226	215	185	180	186	183	2.43	0.019	9.09	6.97	0.082	9.25
MBA	195	6510	190	189	184	193	406	195	192	2.49	0.020	8.61	6.96	0.074	4.37
MBR	203	6604	253	187	182	191	238	192	190	2.47	0.019	8.68	6.96	0.072	5.26

Table 3d - SIM1FLH zone 4-hr avg concentrations

	VOC1 (μg/m³)	VOC2 (μg/m³)	VOC3 (μg/m³)	VOC4 (μg/m³)	VOC5 (μg/m³)	VOC6 (μg/m³)	VOC7 (μg/m³)	VOC8 (μg/m³)	VOC9 (μg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (μg/m³)
BA2	337	NA	322	318	224	334	320	1101	321	4.82	0.060	8.94
BR2	240	NA	310	304	208	322	305	322	308	4.75	0.057	9.12
BR3	242	NA	313	307	212	325	308	325	645	4.76	0.058	9.11
HAL	315	NA	345	331	236	350	338	368	334	4.95	0.067	9.20
KIT	249	NA	320	346	249	608	317	331	319	7.38	0.169	9.26
LDA	235	NA	303	447	305	318	298	313	301	4.63	0.054	9.24
MBA	249	NA	318	313	222	329	1019	328	317	4.73	0.058	9.02
MBR	267	NA	525	307	215	323	482	322	310	4.70	0.054	9.01

Table 3e - SIM1FLH zone 1-hr avg concentrations

	CO.1 (PPM)
BA2	5.25
BR2	5.00
BR3	5.03
HAL	5.92
KIT	14.73
LDA	4.85
MBA	5.15
MBR	4.85

LEGEND

VOC1	Burst - UCL	CO.1	Oven
VOC2	Floor	NO2.1	Oven
VOC3	Burst - MBR	PART.1	Oven
VOC4	Burst - LDA	CO.2	Heater
VOC5	Burst - GAR	NO2.2	Heater
VOC6	Burst - KIT	PART.2	Heater
VOC7	Burst - MBA	CO.3	Outdoor air
VOC8	Burst - BA2	NO2.3	Outdoor air
VOC9	Burst - BR3	PART.3	Outdoor air

Table 4a - SIM1FTC overall 24-hr avg concentrations

	VOC1 (µg/m³)	VOC2 (µg/m³)	VOC3 (µg/m³)	VOC4 (µg/m³)	VOC5 (µg/m³)	VOC6 (µg/m³)	VOC7 (µg/m³)	VOC8 (µg/m³)	VOC9 (µg/m³)	CO.1 ppm	NO2.1 ppm	PART.1 (µg/m³)	CO.2 ppm	NO2.2 ppm	PART.2 (µg/m³)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (µg/m³)
24 hr avg	768	19246	451	402	181	460	472	453	449	4.63	0.025	7.95	1.66	0.003	7.80	6.66	0.032	5.02

Table 4b - SIM1FTC zone peak concentrations

	VOC1 (µg/m³)	VOC2 (µg/m³)	VOC3 (µg/m³)	VOC4 (µg/m³)	VOC5 (µg/m³)	VOC6 (µg/m³)	VOC7 (µg/m³)	VOC8 (µg/m³)	VOC9 (µg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (µg/m³)	CO.2 (PPM)	NO2.2 (PPM)	PART.2 (µg/m³)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (µg/m³)
BA2	745	26616	663	473	202	651	499	15042	566	6.93	0.062	7.92	1.94	0.006	7.72	7.84	0.050	3.57
BR2	266	24005	540	403	188	547	435	518	480	5.78	0.049	8.61	1.95	0.008	8.56	7.98	0.071	8.16
BR3	263	27100	604	427	196	583	480	550	4999	6.09	0.050	7.84	1.92	0.005	7.64	7.81	0.047	4.70
HAL	562	21531	1664	595	242	786	781	735	700	8.69	0.093	8.68	2.02	0.008	8.57	8.23	0.064	8.40
KIT	245	21679	528	564	227	5238	434	517	480	55.25	1.686	13.81	2.03	0.007	8.53	8.17	0.058	8.02
LDA	241	22088	506	2037	514	575	429	476	442	6.66	0.054	8.19	2.11	0.012	8.16	8.14	0.056	6.87
MBA	245	19220	543	417	188	567	12243	535	495	6.25	0.059	9.39	2.07	0.007	9.37	8.47	0.073	11.91
MBR	304	18640	3273	349	175	468	1262	445	412	5.17	0.045	9.59	2.06	0.009	9.50	8.47	0.092	14.25

Table 4c - SIM1FTC zone 24-hr avg concentrations

	VOC1 (µg/m³)	VOC2 (µg/m³)	VOC3 (µg/m³)	VOC4 (µg/m³)	VOC5 (µg/m³)	VOC6 (µg/m³)	VOC7 (µg/m³)	VOC8 (µg/m³)	VOC9 (µg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (µg/m³)	CO.2 (PPM)	NO2.2 (PPM)	PART.2 (µg/m³)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (µg/m³)
BA2	370	21831	435	332	167	423	397	2989	392	4.15	0.007	7.06	1.64	0.002	6.96	6.63	0.019	1.17
BR2	199	19345	360	287	154	361	337	355	336	3.64	0.007	7.76	1.63	0.003	7.68	6.63	0.031	4.72
BR3	215	22228	425	320	163	407	387	399	1368	4.01	0.006	7.05	1.64	0.002	6.96	6.62	0.020	1.72
HAL	244	18147	559	310	164	393	453	382	362	4.01	0.011	8.08	1.65	0.003	7.98	6.69	0.032	4.62
KIT	192	18356	347	332	169	1182	324	344	326	11.45	0.156	8.80	1.65	0.004	7.92	6.67	0.034	5.42
LDA	195	19336	359	653	237	404	331	345	327	4.09	0.011	7.79	1.72	0.003	7.77	6.67	0.029	4.36
MBA	184	16010	325	264	148	328	2220	322	307	3.46	0.009	8.52	1.63	0.005	8.44	6.70	0.045	7.87
MBR	203	15191	782	241	141	296	579	291	277	3.17	0.008	8.80	1.62	0.005	8.74	6.69	0.048	9.21

Table 4d - SIM1FTC zone 4-hr avg concentrations

	VOC1 (µg/m³)	VOC2 (µg/m³)	VOC3 (µg/m³)	VOC4 (µg/m³)	VOC5 (µg/m³)	VOC6 (µg/m³)	VOC7 (µg/m³)	VOC8 (µg/m³)	VOC9 (µg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (µg/m³)	CO.2 (PPM)	NO2.2 (PPM)	PART.2 (µg/m³)
BA2	409	NA	534	378	181	502	429	7730	450	4.26	0.010	6.61	1.47	0.004	7.42
BR2	203	NA	421	321	164	417	361	403	378	3.71	0.008	7.18	1.52	0.006	8.34
BR3	216	NA	495	351	173	461	405	443	3063	3.95	0.008	6.64	1.46	0.003	7.42
HAL	264	NA	956	381	187	522	538	465	451	5.07	0.021	7.76	1.52	0.005	8.29
KIT	188	NA	392	404	192	2859	336	387	363	37.17	0.675	11.35	1.50	0.005	8.13
LDA	190	NA	390	1322	363	479	334	372	350	5.01	0.025	7.64	1.54	0.007	8.03
MBA	179	NA	387	296	156	382	5928	368	346	3.70	0.010	8.35	1.52	0.006	8.52
MBR	208	NA	1828	266	148	339	882	328	310	3.34	0.009	8.49	1.55	0.007	9.07

Table 4e - SIM1FTC zone 1-hr avg concentrations

	CO.1 (PPM)	CO.2 (PPM)
BA2	3.02	1.52
BR2	2.91	1.55
BR3	3.02	1.51
HAL	3.25	1.56
KIT	39.33	1.54
LDA	3.41	1.61
MBA	2.81	1.55
MBR	2.73	1.57

LEGEND

VOC1	Burst - UCL	CO.1	Oven
VOC2	Floor	NO2.1	Oven
VOC3	Burst - MBR	PART.1	Oven
VOC4	Burst - LDA	CO.2	Heater
VOC5	Burst - GAR	NO2.2	Heater
VOC6	Burst - KIT	PART.2	Heater
VOC7	Burst - MBA	CO.3	Outdoor air
VOC8	Burst - BA2	NO2.3	Outdoor air
VOC9	Burst - BR3	PART.3	Outdoor air

Table 5a - SIM1FTM overall 24-hr avg concentrations

	VOC1 (µg/m³)	VOC2 (µg/m³)	VOC3 (µg/m³)	VOC4 (µg/m³)	VOC5 (µg/m³)	VOC6 (µg/m³)	VOC7 (µg/m³)	VOC8 (µg/m³)	VOC9 (µg/m³)	CO.1 ppm	NO2.1 ppm	PART.1 (µg/m³)	CO.3 ppm	NO2.3 ppm	PART.3 (µg/m³)
24 hr avg	682	21165	485	407	136	525	507	505	510	4.18	0.025	9.23	6.94	0.039	7.32

Table 5b - SIM1FTM zone peak concentrations

	VOC1 (µg/m³)	VOC2 (µg/m³)	VOC3 (µg/m³)	VOC4 (µg/m³)	VOC5 (µg/m³)	VOC6 (µg/m³)	VOC7 (µg/m³)	VOC8 (µg/m³)	VOC9 (µg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (µg/m³)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (µg/m³)
BA2	649	33912	688	338	136	535	482	16764	473	4.48	0.025	10.39	9.23	0.084	13.30
BR2	166	26965	423	278	127	426	353	406	381	3.89	0.021	9.88	8.79	0.062	9.94
BR3	168	33256	588	308	130	482	453	459	5598	4.04	0.021	9.50	8.52	0.054	8.70
HAL	468	22311	1694	414	154	640	686	673	576	5.32	0.037	11.39	10.22	0.142	24.15
KIT	143	22296	447	393	148	5588	364	419	394	50.31	1.558	15.24	8.75	0.061	11.10
LDA	145	24215	480	2126	321	582	362	394	369	5.98	0.071	10.26	8.88	0.065	11.07
MBA	143	17811	422	293	130	451	12871	428	403	4.15	0.025	10.73	9.19	0.083	15.94
MBR	202	17054	3333	244	122	365	985	349	328	3.66	0.020	10.04	8.60	0.083	13.82

Table 5c - SIM1FTM zone 24-hr avg concentrations

	VOC1 (µg/m³)	VOC2 (µg/m³)	VOC3 (µg/m³)	VOC4 (µg/m³)	VOC5 (µg/m³)	VOC6 (µg/m³)	VOC7 (µg/m³)	VOC8 (µg/m³)	VOC9 (µg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (µg/m³)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (µg/m³)
BA2	324	28144	531	259	122	400	410	5792	355	2.50	0.005	8.98	7.05	0.037	6.76
BR2	138	21431	314	207	114	298	276	285	270	2.41	0.004	8.79	7.04	0.034	5.94
BR3	152	28226	473	244	119	369	377	350	2356	2.51	0.004	8.37	7.00	0.028	4.88
HAL	186	18383	765	224	117	350	491	325	290	2.51	0.008	9.93	6.92	0.062	13.40
KIT	127	19565	275	247	122	1948	249	259	250	14.24	0.163	10.26	6.88	0.040	7.31
LDA	134	21558	328	845	182	452	277	271	257	4.01	0.012	9.25	6.93	0.038	7.09
MBA	121	15095	242	175	109	237	3606	229	222	2.20	0.006	9.76	6.84	0.052	10.40
MBR	142	14002	994	161	107	211	607	204	199	2.19	0.005	9.31	6.82	0.043	8.23

Table 5d - SIM1FTM zone 4-hr avg concentrations

	VOC1 (µg/m³)	VOC2 (µg/m³)	VOC3 (µg/m³)	VOC4 (µg/m³)	VOC5 (µg/m³)	VOC6 (µg/m³)	VOC7 (µg/m³)	VOC8 (µg/m³)	VOC9 (µg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (µg/m³)
BA2	346	NA	617	258	124	404	422	11952	347	2.09	0.006	10.21
BR2	137	NA	318	205	116	290	280	273	263	2.13	0.004	9.49
BR3	153	NA	495	241	121	362	377	334	4424	2.14	0.004	9.10
HAL	184	NA	1277	255	121	462	507	286	316	2.02	0.009	11.21
KIT	122	NA	246	238	124	4094	223	228	222	35.41	0.623	13.13
LDA	130	NA	294	1637	232	450	253	242	234	5.23	0.039	10.05
MBA	115	NA	234	152	107	194	8311	188	184	2.10	0.006	10.17
MBR	142	NA	2236	150	107	188	703	181	179	2.08	0.004	9.38

Table 5e - SIM1FTM zone 1-hr avg concentrations

	CO.1 (PPM)
BA2	2.30
BR2	2.26
BR3	2.27
HAL	2.47
KIT	37.36
LDA	3.53
MBA	2.29
MBR	2.19

LEGEND

VOC1	Burst - UCL	CO.1	Oven
VOC2	Floor	NO2.1	Oven
VOC3	Burst - MBR	PART.1	Oven
VOC4	Burst - LDA	CO.2	Heater
VOC5	Burst - GAR	NO2.2	Heater
VOC6	Burst - KIT	PART.2	Heater
VOC7	Burst - MBA	CO.3	Outdoor air
VOC8	Burst - BA2	NO2.3	Outdoor air
VOC9	Burst - BR3	PART.3	Outdoor air

Table 6a - SIM1FTH overall 24-hr avg concentrations

	VOC1 (µg/m³)	VOC2 (µg/m³)	VOC3 (µg/m³)	VOC4 (µg/m³)	VOC5 (µg/m³)	VOC6 (µg/m³)	VOC7 (µg/m³)	VOC8 (µg/m³)	VOC9 (µg/m³)	CO.1 ppm	NO2.1 ppm	PART.1 (µg/m³)	CO.3 ppm	NO2.3 ppm	PART.3 (µg/m³)
24 hr avg	465	9517	239	243	507	237	249	237	240	2.91	0.022	7.55	6.99	0.056	4.57

Table 6b - SIM1FTH zone peak concentrations

	VOC1 (µg/m³)	VOC2 (µg/m³)	VOC3 (µg/m³)	VOC4 (µg/m³)	VOC5 (µg/m³)	VOC6 (µg/m³)	VOC7 (µg/m³)	VOC8 (µg/m³)	VOC9 (µg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (µg/m³)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (µg/m³)
BA2	450	13490	562	538	690	593	533	8105	557	7.26	0.167	8.15	9.63	0.108	4.59
BR2	303	12531	521	506	671	534	494	533	519	6.74	0.147	8.17	9.63	0.110	6.50
BR3	306	12882	530	516	678	546	504	545	3081	6.84	0.150	8.14	9.63	0.111	6.77
HAL	357	12933	639	607	728	660	574	659	635	7.93	0.197	8.54	9.63	0.110	9.25
KIT	304	13565	533	631	737	3067	509	552	532	25.60	0.974	10.40	9.62	0.106	4.10
LDA	295	12422	501	1409	870	510	475	509	500	6.48	0.136	8.39	9.65	0.114	8.85
MBA	305	13392	548	532	680	579	7217	578	543	7.05	0.160	8.24	9.64	0.109	5.00
MBR	325	13358	2211	505	669	531	1187	530	519	6.62	0.139	8.21	9.60	0.103	5.71

Table 6c - SIM1FTH zone 24-hr avg concentrations

	VOC1 (µg/m³)	VOC2 (µg/m³)	VOC3 (µg/m³)	VOC4 (µg/m³)	VOC5 (µg/m³)	VOC6 (µg/m³)	VOC7 (µg/m³)	VOC8 (µg/m³)	VOC9 (µg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (µg/m³)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (µg/m³)
BA2	298	9617	235	235	488	236	237	480	236	2.89	0.020	7.29	6.99	0.054	2.63
BR2	231	9354	230	229	468	230	231	230	230	2.84	0.019	7.55	6.98	0.057	4.83
BR3	233	9446	231	231	473	232	233	232	334	2.86	0.019	7.48	6.99	0.056	4.32
HAL	248	9378	240	240	504	240	242	241	240	2.92	0.022	7.54	6.98	0.056	4.75
KIT	235	9590	233	243	515	317	234	233	233	3.72	0.055	7.47	6.99	0.053	3.16
LDA	225	9084	224	270	581	224	225	224	224	2.79	0.018	7.68	6.99	0.058	5.65
MBA	237	9504	234	233	483	234	467	234	234	2.87	0.020	7.37	6.98	0.055	3.34
MBR	251	9639	300	231	475	231	288	231	231	2.84	0.018	7.43	6.98	0.054	3.95

Table 6d - SIM1FTH zone 4-hr avg concentrations

	VOC1 (µg/m³)	VOC2 (µg/m³)	VOC3 (µg/m³)	VOC4 (µg/m³)	VOC5 (µg/m³)	VOC6 (µg/m³)	VOC7 (µg/m³)	VOC8 (µg/m³)	VOC9 (µg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (µg/m³)
BA2	368	NA	382	376	489	385	376	1201	380	5.28	0.064	7.73
BR2	254	NA	370	364	464	374	362	372	369	5.15	0.060	7.87
BR3	257	NA	375	369	472	378	367	377	721	5.19	0.061	7.83
HAL	288	NA	400	391	520	399	393	405	395	5.40	0.072	8.00
KIT	258	NA	376	404	533	664	368	377	374	7.89	0.177	8.11
LDA	247	NA	358	509	663	363	350	360	356	5.00	0.056	8.03
MBA	260	NA	376	371	480	380	1142	378	375	5.20	0.062	7.83
MBR	284	NA	600	362	463	372	542	370	367	5.11	0.058	7.87

Table 6e - SIM1FTH zone 1-hr avg concentrations

	CO.1 (PPM)
BA2	5.33
BR2	4.95
BR3	5.02
HAL	6.00
KIT	15.11
LDA	4.77
MBA	5.20
MBR	4.80

LEGEND

VOC1	Burst - UCL	CO.1	Oven
VOC2	Floor	NO2.1	Oven
VOC3	Burst - MBR	PART.1	Oven
VOC4	Burst - LDA	CO.2	Heater
VOC5	Burst - GAR	NO2.2	Heater
VOC6	Burst - KIT	PART.2	Heater
VOC7	Burst - MBA	CO.3	Outdoor air
VOC8	Burst - BA2	NO2.3	Outdoor air
VOC9	Burst - BR3	PART.3	Outdoor air

Table 7a - SIM1MLC overall 24-hr avg concentrations

	VOC1 (μg/m³)	VOC2 (μg/m³)	VOC3 (μg/m³)	VOC4 (μg/m³)	VOC5 (μg/m³)	VOC6 (μg/m³)	VOC7 (μg/m³)	VOC8 (μg/m³)	VOC9 (μg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (μg/m³)	CO.2 (PPM)	NO2.2 (PPM)	PART.2 (μg/m³)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (μg/m³)
24 hr avg	182	2767	144	140	127	145	143	364	144	2.01	0.020	10.23	1.84	0.018	10.58	6.70	0.102	14.46

Table 7b - SIM1MLC zone peak concentrations

	VOC1 (μg/m³)	VOC2 (μg/m³)	VOC3 (μg/m³)	VOC4 (μg/m³)	VOC5 (μg/m³)	VOC6 (μg/m³)	VOC7 (μg/m³)	VOC8 (μg/m³)	VOC9 (μg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (μg/m³)	CO.2 (PPM)	NO2.2 (PPM)	PART.2 (μg/m³)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (μg/m³)
BA2	98	3854	387	342	221	380	314	1237	356	5.27	0.108	9.84	3.37	0.112	11.96	10.02	0.129	5.39
BR2	98	3009	294	276	187	303	250	924	285	4.33	0.081	11.16	2.85	0.083	12.23	10.87	0.198	28.28
BR3	98	3537	365	300	208	331	306	1111	2820	4.81	0.092	10.36	3.15	0.096	11.94	10.12	0.139	19.51
HAL	98	3267	909	252	192	279	583	963	265	4.56	0.082	11.42	2.98	0.082	12.04	10.59	0.170	29.73
KIT	98	3446	336	280	204	2864	276	1061	293	14.70	0.544	11.41	3.12	0.095	12.02	10.26	0.180	24.14
LDA	98	3187	355	1079	355	413	293	1065	301	5.28	0.112	10.66	3.09	0.095	12.02	10.24	0.168	20.75
MBA	98	2890	298	281	201	308	6114	1034	294	4.78	0.095	11.38	3.08	0.097	12.16	10.46	0.216	33.26
MBR	98	2633	1588	236	179	257	804	836	243	4.20	0.077	11.84	2.75	0.076	12.26	11.06	0.220	38.91

Table 7c - SIM1MLC zone 24-hr avg concentrations

	VOC1 (μg/m³)	VOC2 (μg/m³)	VOC3 (μg/m³)	VOC4 (μg/m³)	VOC5 (μg/m³)	VOC6 (μg/m³)	VOC7 (μg/m³)	VOC8 (μg/m³)	VOC9 (μg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (μg/m³)	CO.2 (PPM)	NO2.2 (PPM)	PART.2 (μg/m³)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (μg/m³)
BA2	98	3213	143	140	128	143	134	452	140	2.01	0.016	9.43	1.91	0.018	9.89	6.70	0.080	2.24
BR2	98	2582	127	128	119	130	122	343	127	1.89	0.017	10.38	1.81	0.018	10.69	6.69	0.108	16.86
BR3	98	3157	138	136	124	138	131	412	251	1.96	0.016	9.76	1.86	0.017	10.14	6.68	0.087	7.32
HAL	98	2741	159	128	121	130	144	347	128	1.91	0.016	10.35	1.84	0.017	10.69	6.72	0.103	15.64
KIT	98	2738	134	132	123	237	127	379	132	2.65	0.048	10.23	1.86	0.019	10.53	6.72	0.101	13.38
LDA	98	2719	135	165	142	140	128	379	132	1.97	0.018	10.12	1.86	0.020	10.51	6.69	0.099	12.39
MBA	98	2396	129	129	121	131	339	359	129	1.91	0.018	10.40	1.84	0.020	10.76	6.72	0.113	17.77
MBR	98	2166	179	122	117	124	155	301	122	1.85	0.017	10.87	1.79	0.019	11.16	6.72	0.125	24.87

Table 7d - SIM1MLC zone 4-hr avg concentrations

	VOC1 (μg/m³)	VOC2 (μg/m³)	VOC3 (μg/m³)	VOC4 (μg/m³)	VOC5 (μg/m³)	VOC6 (μg/m³)	VOC7 (μg/m³)	VOC8 (μg/m³)	VOC9 (μg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (μg/m³)	CO.2 (PPM)	NO2.2 (PPM)	PART.2 (μg/m³)
BA2	98	NA	213	203	191	209	181	865	205	2.91	0.022	9.15	2.98	0.062	11.03
BR2	98	NA	169	170	161	174	152	620	171	2.48	0.020	10.33	2.52	0.047	11.60
BR3	98	NA	192	190	178	195	168	763	554	2.78	0.021	9.59	2.79	0.054	11.19
HAL	98	NA	268	176	166	180	209	664	180	2.63	0.020	9.97	2.63	0.047	11.35
KIT	98	NA	196	187	177	523	171	750	188	3.03	0.030	9.68	2.78	0.054	11.24
LDA	98	NA	192	291	270	207	168	731	187	2.73	0.022	9.76	2.73	0.053	11.29
MBA	98	NA	182	183	174	187	875	719	184	2.62	0.021	9.87	2.71	0.054	11.41
MBR	98	NA	346	163	156	167	256	577	164	2.41	0.020	10.50	2.45	0.044	11.67

Table 7e - SIM1MLC zone 1-hr avg concentrations

	CO.1 (PPM)	CO.2 (PPM)
BA2	4.46	1.73
BR2	3.87	1.70
BR3	4.09	1.73
HAL	3.88	1.69
KIT	12.99	1.69
LDA	4.61	1.71
MBA	4.18	1.67
MBR	3.77	1.65

LEGEND

VOC1	Burst - UCL	CO.1	Oven
VOC2	Floor	NO2.1	Oven
VOC3	Burst - MBR	PART.1	Oven
VOC4	Burst - LDA	CO.2	Heater
VOC5	Burst - GAR	NO2.2	Heater
VOC6	Burst - KIT	PART.2	Heater
VOC7	Burst - MBA	CO.3	Outdoor air
VOC8	Burst - BMT	NO2.3	Outdoor air
VOC9	Burst - BR3	PART.3	Outdoor air

Table 8a - SIM1MLM overall 24-hr avg concentrations

	VOC1 (μg/m³)	VOC2 (μg/m³)	VOC3 (μg/m³)	VOC4 (μg/m³)	VOC5 (μg/m³)	VOC6 (μg/m³)	VOC7 (μg/m³)	VOC8 (μg/m³)	VOC9 (μg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (μg/m³)	CO.2 (PPM)	NO2.2 (PPM)	PART.2 (μg/m³)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (μg/m³)
24 hr avg	265	3489	133	146	176	145	133	325	153	1.99	0.020	10.85	1.93	0.018	11.32	6.69	0.096	18.68

Table 8b - SIM1MLM zone peak concentrations

	VOC1 (μg/m³)	VOC2 (μg/m³)	VOC3 (μg/m³)	VOC4 (μg/m³)	VOC5 (μg/m³)	VOC6 (μg/m³)	VOC7 (μg/m³)	VOC8 (μg/m³)	VOC9 (μg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (μg/m³)	CO.2 (PPM)	NO2.2 (PPM)	PART.2 (μg/m³)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (μg/m³)
BA2	201	6676	276	341	404	334	172	1012	399	3.59	0.045	11.44	2.72	0.076	12.82	10.02	0.118	16.43
BR2	106	5570	210	243	284	241	148	693	253	2.80	0.037	12.57	2.74	0.052	12.97	11.10	0.205	45.70
BR3	106	5680	208	241	280	240	149	693	3319	2.84	0.038	12.64	2.78	0.052	13.01	11.26	0.225	47.60
HAL	179	6043	205	625	586	559	141	723	986	5.27	0.119	12.48	2.83	0.068	13.00	10.97	0.185	40.18
KIT	109	5890	246	596	688	3773	160	896	301	28.52	1.042	14.11	2.96	0.064	12.82	10.61	0.133	24.40
LDA	108	4923	219	1286	974	253	153	755	264	2.83	0.039	12.57	3.66	0.134	15.32	11.21	0.213	44.53
MBA	132	6702	913	327	404	320	9352	971	427	4.20	0.050	11.62	2.66	0.072	12.78	10.37	0.118	21.86
MBR	161	5966	2192	378	491	343	586	811	568	4.77	0.082	12.14	2.63	0.052	12.68	10.69	0.138	32.30

Table 8c - SIM1MLM zone 24-hr avg concentrations

	VOC1 (μg/m³)	VOC2 (μg/m³)	VOC3 (μg/m³)	VOC4 (μg/m³)	VOC5 (μg/m³)	VOC6 (μg/m³)	VOC7 (μg/m³)	VOC8 (μg/m³)	VOC9 (μg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (μg/m³)	CO.2 (PPM)	NO2.2 (PPM)	PART.2 (μg/m³)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (μg/m³)
BA2	107	4709	122	143	169	139	111	476	152	1.87	0.010	9.80	2.03	0.013	10.39	6.66	0.060	4.72
BR2	99	2946	109	115	125	114	104	285	115	1.70	0.013	11.16	1.83	0.014	11.45	6.72	0.111	24.28
BR3	99	2755	108	114	122	112	103	276	289	1.70	0.013	11.26	1.83	0.015	11.55	6.75	0.117	25.98
HAL	104	3281	110	143	169	136	105	308	175	1.93	0.019	10.96	1.92	0.017	11.41	6.70	0.098	19.41
KIT	99	4031	115	157	199	342	107	391	126	3.77	0.082	10.58	2.00	0.016	10.94	6.66	0.074	10.09
LDA	99	2539	108	174	219	112	103	291	114	1.69	0.013	11.22	1.99	0.026	11.86	6.72	0.112	24.12
MBA	101	4537	171	140	167	136	636	430	153	1.86	0.011	10.03	1.97	0.013	10.55	6.60	0.065	7.02
MBR	103	4057	224	139	167	134	134	354	162	1.89	0.014	10.52	1.91	0.014	10.96	6.62	0.078	12.51

Table 8d - SIM1MLM zone 4-hr avg concentrations

	VOC1 (μg/m³)	VOC2 (μg/m³)	VOC3 (μg/m³)	VOC4 (μg/m³)	VOC5 (μg/m³)	VOC6 (μg/m³)	VOC7 (μg/m³)	VOC8 (μg/m³)	VOC9 (μg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (μg/m³)	CO.2 (PPM)	NO2.2 (PPM)	PART.2 (μg/m³)
BA2	100	NA	150	186	207	178	118	471	214	2.29	0.016	10.98	2.26	0.028	11.78
BR2	98	NA	117	124	119	123	105	225	124	1.76	0.016	12.24	1.81	0.022	12.54
BR3	98	NA	115	121	117	120	104	217	409	1.73	0.016	12.31	1.79	0.022	12.59
HAL	99	NA	118	166	207	148	105	242	237	1.94	0.019	12.14	1.84	0.021	12.44
KIT	99	NA	134	215	302	555	112	369	149	3.77	0.060	11.66	2.10	0.025	12.07
LDA	98	NA	116	223	331	121	105	243	123	1.75	0.015	12.20	1.83	0.023	12.54
MBA	99	NA	252	182	208	172	1028	420	222	2.35	0.018	11.16	2.20	0.026	11.84
MBR	99	NA	317	172	208	157	165	306	228	2.18	0.019	11.72	1.99	0.022	12.14

Table 8e - SIM1MLM zone 1-hr avg concentrations

	CO.1 (PPM)	CO.2 (PPM)
BA2	2.99	2.43
BR2	2.60	2.03
BR3	2.59	2.00
HAL	4.80	2.66
KIT	24.09	2.76
LDA	2.61	3.39
MBA	3.23	2.37
MBR	4.03	2.47

LEGEND

VOC1	Burst - UCL	CO.1	Oven
VOC2	Floor	NO2.1	Oven
VOC3	Burst - MBR	PART.1	Oven
VOC4	Burst - LDA	CO.2	Heater
VOC5	Burst - GAR	NO2.2	Heater
VOC6	Burst - KIT	PART.2	Heater
VOC7	Burst - MBA	CO.3	Outdoor air
VOC8	Burst - BMT	NO2.3	Outdoor air
VOC9	Burst - BR3	PART.3	Outdoor air

Table 9a - SIM1MLH overall 24-hr avg concentrations

	VOC1 (μg/m³)	VOC2 (μg/m³)	VOC3 (μg/m³)	VOC4 (μg/m³)	VOC5 (μg/m³)	VOC6 (μg/m³)	VOC7 (μg/m³)	VOC8 (μg/m³)	VOC9 (μg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (μg/m³)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (μg/m³)
24 hr avg	243	3171	132	137	131	136	128	333	141	1.94	0.020	10.59	6.67	0.099	23.44

Table 9b - SIM1MLH zone peak concentrations

	VOC1 (μg/m³)	VOC2 (μg/m³)	VOC3 (μg/m³)	VOC4 (μg/m³)	VOC5 (μg/m³)	VOC6 (μg/m³)	VOC7 (μg/m³)	VOC8 (μg/m³)	VOC9 (μg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (μg/m³)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (μg/m³)
BA2	98	8561	331	365	272	369	242	1285	413	4.91	0.099	10.49	10.29	0.136	23.12
BR2	98	4467	267	290	228	294	199	938	308	4.12	0.076	12.13	11.15	0.214	40.53
BR3	98	3891	266	289	224	293	197	947	2211	4.05	0.076	12.32	11.31	0.231	44.15
HAL	98	4786	278	336	285	300	209	1049	739	4.39	0.080	12.03	11.09	0.197	36.34
KIT	98	7059	314	394	316	2743	229	1230	375	23.57	0.889	12.17	10.34	0.136	22.78
LDA	98	3559	279	946	514	309	206	1031	329	4.20	0.080	12.20	11.23	0.218	41.04
MBA	98	9689	534	356	270	361	6040	1273	411	4.87	0.096	10.50	10.31	0.134	22.69
MBR	98	7578	1556	328	265	320	776	1142	491	4.63	0.085	11.30	10.39	0.135	25.50

Table 9c - SIM1MLH zone 24-hr avg concentrations

	VOC1 (μg/m³)	VOC2 (μg/m³)	VOC3 (μg/m³)	VOC4 (μg/m³)	VOC5 (μg/m³)	VOC6 (μg/m³)	VOC7 (μg/m³)	VOC8 (μg/m³)	VOC9 (μg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (μg/m³)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (μg/m³)
BA2	98	4263	131	140	134	137	122	445	144	1.94	0.014	9.66	6.78	0.070	13.53
BR2	98	2533	118	122	116	121	112	287	123	1.75	0.016	11.05	6.63	0.117	29.54
BR3	98	2298	117	121	115	120	111	279	194	1.73	0.016	11.16	6.61	0.123	31.44
HAL	98	2839	121	130	125	126	114	316	153	1.81	0.016	10.75	6.63	0.103	23.93
KIT	98	3858	128	140	137	227	119	399	137	3.10	0.062	10.12	6.73	0.077	15.31
LDA	98	2271	118	149	144	122	112	300	124	1.76	0.016	10.95	6.63	0.115	28.60
MBA	98	4543	142	140	134	137	324	436	144	1.94	0.013	9.64	6.81	0.068	12.80
MBR	98	3920	178	135	129	132	145	374	145	1.87	0.013	10.14	6.71	0.079	16.02

Table 9d - SIM1MLH zone 4-hr avg concentrations

	VOC1 (μg/m³)	VOC2 (μg/m³)	VOC3 (μg/m³)	VOC4 (μg/m³)	VOC5 (μg/m³)	VOC6 (μg/m³)	VOC7 (μg/m³)	VOC8 (μg/m³)	VOC9 (μg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (μg/m³)
BA2	98	NA	179	202	207	197	155	811	216	2.64	0.019	9.63
BR2	98	NA	147	158	156	157	132	498	163	2.19	0.018	11.05
BR3	98	NA	143	154	152	152	129	465	394	2.12	0.018	11.23
HAL	98	NA	152	186	191	170	135	534	260	2.30	0.019	10.81
KIT	98	NA	173	213	226	504	150	727	200	3.08	0.035	10.01
LDA	98	NA	146	243	275	156	131	491	162	2.16	0.018	11.10
MBA	98	NA	230	202	206	197	807	800	218	2.67	0.019	9.62
MBR	98	NA	337	195	198	186	230	678	234	2.56	0.019	10.07

Table 9e - SIM1MLH zone 1-hr avg concentrations

	CO.1 (PPM)
BA2	3.92
BR2	3.48
BR3	3.46
HAL	3.77
KIT	17.02
LDA	3.54
MBA	3.85
MBR	3.73

LEGEND

VOC1	Burst - UCL	CO.1	Oven
VOC2	Floor	NO2.1	Oven
VOC3	Burst - MBR	PART.1	Oven
VOC4	Burst - LDA	CO.2	Heater
VOC5	Burst - GAR	NO2.2	Heater
VOC6	Burst - KIT	PART.2	Heater
VOC7	Burst - MBA	CO.3	Outdoor air
VOC8	Burst - BMT	NO2.3	Outdoor air
VOC9	Burst - BR3	PART.3	Outdoor air

Table 10a - SIM1MTC overall 24-hr avg concentrations

	VOC1 (μg/m³)	VOC2 (μg/m³)	VOC3 (μg/m³)	VOC4 (μg/m³)	VOC5 (μg/m³)	VOC6 (μg/m³)	VOC7 (μg/m³)	VOC8 (μg/m³)	VOC9 (μg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (μg/m³)	CO.2 (PPM)	NO2.2 (PPM)	PART.2 (μg/m³)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (μg/m³)
24 hr avg	213	5161	185	186	266	187	183	728	188	2.79	0.018	6.83	2.43	0.016	7.62	6.66	0.045	4.96

Table 10b - SIM1MTC zone peak concentrations

	VOC1 (μg/m³)	VOC2 (μg/m³)	VOC3 (μg/m³)	VOC4 (μg/m³)	VOC5 (μg/m³)	VOC6 (μg/m³)	VOC7 (μg/m³)	VOC8 (μg/m³)	VOC9 (μg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (μg/m³)	CO.2 (PPM)	NO2.2 (PPM)	PART.2 (μg/m³)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (μg/m³)
BA2	98	6328	420	417	453	432	366	1672	418	5.88	0.121	6.61	4.24	0.128	9.94	8.24	0.059	0.80
BR2	98	5232	360	355	399	370	311	1447	363	5.30	0.102	7.52	3.96	0.107	10.13	8.61	0.083	10.48
BR3	98	6145	380	374	423	390	327	1550	3067	5.50	0.107	6.87	4.11	0.113	9.92	8.30	0.064	6.76
HAL	98	5983	623	463	455	537	481	1523	397	5.49	0.097	7.37	4.10	0.102	9.89	8.34	0.062	6.94
KIT	98	5826	378	392	433	3104	328	1565	378	16.44	0.607	8.15	4.14	0.115	9.94	8.31	0.076	8.10
LDA	98	5581	380	1182	762	420	331	1485	376	5.98	0.126	7.39	4.07	0.115	10.01	8.35	0.078	8.93
MBA	98	5458	392	381	426	394	6987	1549	382	5.68	0.115	7.71	4.13	0.121	10.06	8.35	0.092	11.46
MBR	98	5135	2073	334	392	348	1052	1402	342	5.22	0.098	8.33	3.93	0.102	10.14	8.72	0.098	15.41

Table 10c - SIM1MTC zone 24-hr avg concentrations

	VOC1 (μg/m³)	VOC2 (μg/m³)	VOC3 (μg/m³)	VOC4 (μg/m³)	VOC5 (μg/m³)	VOC6 (μg/m³)	VOC7 (μg/m³)	VOC8 (μg/m³)	VOC9 (μg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (μg/m³)	CO.2 (PPM)	NO2.2 (PPM)	PART.2 (μg/m³)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (μg/m³)
BA2	98	5530	182	186	267	185	170	826	183	2.80	0.015	6.30	2.51	0.017	7.18	6.66	0.035	0.71
BR2	98	4967	167	171	239	170	158	705	169	2.66	0.014	6.98	2.41	0.016	7.75	6.67	0.049	6.00
BR3	98	5392	175	179	252	178	164	768	305	2.74	0.014	6.52	2.46	0.016	7.34	6.65	0.039	2.59
HAL	98	5543	192	181	256	181	179	753	179	2.72	0.013	6.70	2.45	0.015	7.51	6.67	0.040	3.53
KIT	98	5206	173	179	253	299	163	756	175	3.54	0.050	6.86	2.44	0.017	7.58	6.66	0.044	4.38
LDA	98	4859	169	211	311	174	160	726	171	2.72	0.016	6.79	2.43	0.018	7.61	6.65	0.044	4.32
MBA	98	4923	172	175	246	174	421	739	173	2.69	0.015	6.92	2.43	0.018	7.73	6.67	0.049	5.75
MBR	98	4729	241	166	230	165	210	666	164	2.60	0.015	7.37	2.36	0.016	8.11	6.68	0.057	9.05

Table 10d - SIM1MTC zone 4-hr avg concentrations

	VOC1 (μg/m³)	VOC2 (μg/m³)	VOC3 (μg/m³)	VOC4 (μg/m³)	VOC5 (μg/m³)	VOC6 (μg/m³)	VOC7 (μg/m³)	VOC8 (μg/m³)	VOC9 (μg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (μg/m³)	CO.2 (PPM)	NO2.2 (PPM)	PART.2 (μg/m³)
BA2	98	NA	261	266	388	267	233	1309	262	4.18	0.027	6.12	3.58	0.073	8.75
BR2	98	NA	231	236	336	236	209	1101	234	3.90	0.025	6.91	3.29	0.062	9.13
BR3	98	NA	244	249	358	249	219	1193	639	4.09	0.026	6.43	3.43	0.066	8.83
HAL	98	NA	292	264	367	270	254	1173	261	4.12	0.026	6.43	3.39	0.060	8.74
KIT	98	NA	247	260	371	631	221	1213	249	4.53	0.040	6.45	3.45	0.067	8.84
LDA	98	NA	236	357	561	245	212	1139	238	4.04	0.027	6.61	3.40	0.066	8.97
MBA	98	NA	251	248	360	248	1042	1197	247	4.03	0.026	6.51	3.46	0.069	8.98
MBR	98	NA	473	231	328	231	363	1068	229	3.86	0.025	7.00	3.25	0.060	9.17

Table 10e - SIM1MTC zone 1-hr avg concentrations

	CO.1 (PPM)	CO.2 (PPM)
BA2	4.67	2.13
BR2	4.24	2.08
BR3	4.33	2.12
HAL	4.09	2.09
KIT	14.42	2.08
LDA	4.81	2.16
MBA	4.54	2.06
MBR	4.14	2.02

LEGEND

VOC1	Burst - UCL	CO.1	Oven
VOC2	Floor	NO2.1	Oven
VOC3	Burst - MBR	PART.1	Oven
VOC4	Burst - LDA	CO.2	Heater
VOC5	Burst - GAR	NO2.2	Heater
VOC6	Burst - KIT	PART.2	Heater
VOC7	Burst - MBA	CO.3	Outdoor air
VOC8	Burst - BMT	NO2.3	Outdoor air
VOC9	Burst - BR3	PART.3	Outdoor air

Table 11a - SIM1MTM overall 24-hr avg concentrations

	VOC1 (μg/m³)	VOC2 (μg/m³)	VOC3 (μg/m³)	VOC4 (μg/m³)	VOC5 (μg/m³)	VOC6 (μg/m³)	VOC7 (μg/m³)	VOC8 (μg/m³)	VOC9 (μg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (μg/m³)	CO.2 (PPM)	NO2.2 (PPM)	PART.2 (μg/m³)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (μg/m³)
24 hr avg	526	10674	235	257	295	254	231	1144	270	2.85	0.021	7.84	2.79	0.012	8.91	6.72	0.041	6.67

Table 11b - SIM1MTM zone peak concentrations

	VOC1 (μg/m³)	VOC2 (μg/m³)	VOC3 (μg/m³)	VOC4 (μg/m³)	VOC5 (μg/m³)	VOC6 (μg/m³)	VOC7 (μg/m³)	VOC8 (μg/m³)	VOC9 (μg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (μg/m³)	CO.2 (PPM)	NO2.2 (PPM)	PART.2 (μg/m³)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (μg/m³)
BA2	316	14022	424	467	427	464	301	1944	494	5.22	0.066	8.53	3.50	0.084	11.03	8.12	0.046	5.21
BR2	119	11897	339	375	351	370	264	1617	377	4.11	0.048	10.78	3.38	0.063	11.58	8.88	0.084	20.72
BR3	119	12009	341	379	348	374	263	1603	4320	4.14	0.049	10.85	3.37	0.064	11.56	9.05	0.094	22.08
HAL	267	12553	323	731	590	670	264	1655	801	8.41	0.191	10.46	3.45	0.050	11.34	8.85	0.070	15.00
KIT	126	13682	379	534	604	4690	287	1833	425	44.53	1.458	12.48	3.48	0.071	11.03	8.46	0.045	7.12
LDA	123	11160	353	1721	959	428	264	1630	406	4.34	0.054	11.09	3.87	0.076	11.87	9.20	0.103	24.13
MBA	131	14489	730	450	408	448	11599	1917	454	5.07	0.060	8.42	3.49	0.079	10.82	8.09	0.044	6.87
MBR	198	14684	3046	430	424	425	1193	1794	519	5.33	0.065	9.45	3.47	0.059	10.79	8.32	0.048	10.67

Table 11c - SIM1MTM zone 24-hr avg concentrations

	VOC1 (μg/m³)	VOC2 (μg/m³)	VOC3 (μg/m³)	VOC4 (μg/m³)	VOC5 (μg/m³)	VOC6 (μg/m³)	VOC7 (μg/m³)	VOC8 (μg/m³)	VOC9 (μg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (μg/m³)	CO.2 (PPM)	NO2.2 (PPM)	PART.2 (μg/m³)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (μg/m³)
BA2	120	11788	219	254	288	246	192	1397	262	2.68	0.009	6.90	2.99	0.010	8.14	6.72	0.023	1.07
BR2	104	9704	185	207	230	200	166	1068	208	2.31	0.008	8.15	2.65	0.010	9.07	6.72	0.048	8.83
BR3	103	9391	183	204	227	197	164	1050	544	2.30	0.009	8.27	2.65	0.010	9.19	6.74	0.051	9.51
HAL	115	10512	192	254	292	246	172	1139	290	2.82	0.019	7.84	2.79	0.010	8.90	6.72	0.037	5.56
KIT	105	11433	207	266	312	580	183	1297	238	6.06	0.113	7.61	2.92	0.010	8.42	6.71	0.027	2.37
LDA	103	8585	177	302	352	195	160	1024	199	2.28	0.009	8.46	2.78	0.017	9.70	6.74	0.055	10.38
MBA	107	12025	275	252	283	244	1054	1380	259	2.66	0.008	6.89	2.95	0.010	8.09	6.70	0.023	1.47
MBR	111	12037	435	249	284	241	306	1278	265	2.69	0.010	7.15	2.87	0.008	8.24	6.68	0.025	2.63

Table 11d - SIM1MTM zone 4-hr avg concentrations

	VOC1 (μg/m³)	VOC2 (μg/m³)	VOC3 (μg/m³)	VOC4 (μg/m³)	VOC5 (μg/m³)	VOC6 (μg/m³)	VOC7 (μg/m³)	VOC8 (μg/m³)	VOC9 (μg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (μg/m³)	CO.2 (PPM)	NO2.2 (PPM)	PART.2 (μg/m³)
BA2	108	NA	288	343	344	337	222	1344	368	4.04	0.023	8.07	2.99	0.033	9.47
BR2	102	NA	212	231	219	228	171	830	234	2.83	0.017	9.87	2.43	0.025	10.70
BR3	102	NA	206	224	214	221	168	796	933	2.76	0.017	10.07	2.40	0.025	10.90
HAL	104	NA	218	323	383	316	176	911	416	3.91	0.034	9.64	2.52	0.024	10.45
KIT	104	NA	259	373	435	1037	202	1160	293	9.51	0.137	9.29	2.81	0.029	9.85
LDA	102	NA	195	419	562	211	161	778	215	2.68	0.017	10.29	2.42	0.028	11.20
MBA	107	NA	464	340	332	334	2020	1357	363	4.06	0.021	7.81	2.98	0.030	9.15
MBR	106	NA	736	330	346	324	496	1152	379	4.16	0.025	8.45	2.75	0.024	9.44

Table 11e - SIM1MTM zone 1-hr avg concentrations

	CO.1 (PPM)	CO.2 (PPM)
BA2	2.67	3.03
BR2	2.43	2.76
BR3	2.46	2.73
HAL	5.98	3.10
KIT	34.20	3.08
LDA	2.49	3.62
MBA	2.46	3.01
MBR	3.13	2.99

LEGEND

VOC1	Burst - UCL	CO.1	Oven
VOC2	Floor	NO2.1	Oven
VOC3	Burst - MBR	PART.1	Oven
VOC4	Burst - LDA	CO.2	Heater
VOC5	Burst - GAR	NO2.2	Heater
VOC6	Burst - KIT	PART.2	Heater
VOC7	Burst - MBA	CO.3	Outdoor air
VOC8	Burst - BMT	NO2.3	Outdoor air
VOC9	Burst - BR3	PART.3	Outdoor air

Table 12a - SIM1MTH overall 24-hr avg concentrations

	VOC1 ($\mu g/m^3$)	VOC2 ($\mu g/m^3$)	VOC3 ($\mu g/m^3$)	VOC4 ($\mu g/m^3$)	VOC5 ($\mu g/m^3$)	VOC6 ($\mu g/m^3$)	VOC7 ($\mu g/m^3$)	VOC8 ($\mu g/m^3$)	VOC9 ($\mu g/m^3$)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 ($\mu g/m^3$)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 ($\mu g/m^3$)
24 hr avg	446	9448	227	232	205	232	223	1025	238	2.80	0.019	7.38	6.88	0.044	9.09

Table 12b - SIM1MTH zone peak concentrations

	VOC1 ($\mu g/m^3$)	VOC2 ($\mu g/m^3$)	VOC3 ($\mu g/m^3$)	VOC4 ($\mu g/m^3$)	VOC5 ($\mu g/m^3$)	VOC6 ($\mu g/m^3$)	VOC7 ($\mu g/m^3$)	VOC8 ($\mu g/m^3$)	VOC9 ($\mu g/m^3$)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 ($\mu g/m^3$)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 ($\mu g/m^3$)
BA2	98	17962	478	476	296	491	414	2195	495	5.80	0.121	6.81	8.62	0.060	9.92
BR2	98	12331	423	423	273	435	381	1972	437	5.25	0.103	9.33	9.02	0.090	16.85
BR3	98	11254	424	423	272	435	380	1992	2863	5.26	0.104	9.79	9.18	0.100	18.47
HAL	98	12252	429	467	326	464	391	2056	688	5.73	0.104	9.19	8.78	0.071	11.52
KIT	98	15709	456	477	338	3169	406	2158	485	27.39	1.028	9.12	8.63	0.058	9.44
LDA	98	10416	431	1194	508	478	384	2024	455	5.70	0.120	10.16	9.31	0.107	20.27
MBA	98	20365	552	471	294	485	7540	2188	489	5.73	0.118	6.75	8.59	0.058	9.74
MBR	98	17774	2066	440	292	451	1209	2105	459	5.43	0.104	7.04	8.56	0.054	10.02

Table 12c - SIM1MTH zone 24-hr avg concentrations

	VOC1 ($\mu g/m^3$)	VOC2 ($\mu g/m^3$)	VOC3 ($\mu g/m^3$)	VOC4 ($\mu g/m^3$)	VOC5 ($\mu g/m^3$)	VOC6 ($\mu g/m^3$)	VOC7 ($\mu g/m^3$)	VOC8 ($\mu g/m^3$)	VOC9 ($\mu g/m^3$)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 ($\mu g/m^3$)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 ($\mu g/m^3$)
BA2	98	10703	237	247	206	244	224	1229	250	2.90	0.013	6.39	7.10	0.029	4.90
BR2	98	8615	205	213	170	210	195	959	214	2.53	0.013	7.78	6.82	0.051	11.21
BR3	98	8217	202	209	166	207	192	930	318	2.48	0.013	7.95	6.77	0.055	12.03
HAL	98	9052	213	226	204	223	202	1019	244	2.67	0.014	7.42	6.83	0.040	7.48
KIT	98	10245	227	240	216	344	215	1144	239	4.27	0.068	6.93	6.99	0.031	5.35
LDA	98	7433	197	238	230	204	188	901	206	2.46	0.014	8.08	6.74	0.057	12.57
MBA	98	11316	249	252	207	249	484	1266	254	2.98	0.012	6.17	7.19	0.028	4.72
MBR	98	10968	309	243	206	239	276	1176	246	2.85	0.012	6.56	7.06	0.029	4.97

Table 12d - SIM1MTH zone 4-hr avg concentrations

	VOC1 ($\mu g/m^3$)	VOC2 ($\mu g/m^3$)	VOC3 ($\mu g/m^3$)	VOC4 ($\mu g/m^3$)	VOC5 ($\mu g/m^3$)	VOC6 ($\mu g/m^3$)	VOC7 ($\mu g/m^3$)	VOC8 ($\mu g/m^3$)	VOC9 ($\mu g/m^3$)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 ($\mu g/m^3$)
BA2	98	NA	326	337	254	338	300	1598	349	4.16	0.026	6.41
BR2	98	NA	287	295	218	297	265	1305	303	3.73	0.024	7.51
BR3	98	NA	281	289	215	290	260	1268	659	3.65	0.024	7.71
HAL	98	NA	298	327	269	324	274	1362	388	3.98	0.027	7.11
KIT	98	NA	319	342	272	703	293	1527	343	4.83	0.047	6.67
LDA	98	NA	275	398	383	293	254	1230	293	3.61	0.025	7.89
MBA	98	NA	355	339	251	340	1138	1604	349	4.19	0.026	6.34
MBR	98	NA	581	335	251	336	476	1530	352	4.20	0.026	6.42

Table 12e - SIM1MTH zone 1-hr avg concentrations

	CO.1 (PPM)
BA2	4.15
BR2	3.81
BR3	3.84
HAL	4.31
KIT	19.10
LDA	4.12
MBA	4.06
MBR	3.84

LEGEND

VOC1	Burst - UCL	CO.1	Oven
VOC2	Floor	NO2.1	Oven
VOC3	Burst - MBR	PART.1	Oven
VOC4	Burst - LDA	CO.2	Heater
VOC5	Burst - GAR	NO2.2	Heater
VOC6	Burst - KIT	PART.2	Heater
VOC7	Burst - MBA	CO.3	Outdoor air
VOC8	Burst - BMT	NO2.3	Outdoor air
VOC9	Burst - BR3	PART.3	Outdoor air

Table 13a - SIM2FLC overall 24-hr avg concentrations

	VOC1 (µg/m^3)	VOC2 (µg/m^3)	VOC3 (µg/m^3)	VOC4 (µg/m^3)	VOC5 (µg/m^3)	VOC6 (µg/m^3)	VOC7 (µg/m^3)	VOC8 (µg/m^3)	VOC9 (µg/m^3)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (µg/m^3)	CO.2 (PPM)	NO2.2 (PPM)	PART.2 (µg/m^3)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (µg/m^3)
24 hr avg	813	9167	127	165	149	178	144	121	157	2.26	0.019	10.87	1.59	0.009	10.81	6.68	0.086	15.79

Table 13b - SIM2FLC zone peak concentrations

	VOC1 (µg/m^3)	VOC2 (µg/m^3)	VOC3 (µg/m^3)	VOC4 (µg/m^3)	VOC5 (µg/m^3)	VOC6 (µg/m^3)	VOC7 (µg/m^3)	VOC8 (µg/m^3)	VOC9 (µg/m^3)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (µg/m^3)	CO.2 (PPM)	NO2.2 (PPM)	PART.2 (µg/m^3)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (µg/m^3)
BA2	461	12014	107	384	412	325	11511	181	304	4.22	0.064	10.73	2.31	0.014	10.65	9.67	0.120	8.28
BA3	120	14271	108	259	200	350	229	166	271	3.78	0.073	10.73	2.19	0.015	10.61	9.28	0.127	1.51
BR2	106	6456	104	182	146	244	170	165	188	3.35	0.055	11.89	2.52	0.020	11.88	10.40	0.200	30.38
BR3	108	6820	106	193	153	257	177	162	4046	3.39	0.056	11.99	2.52	0.018	11.99	10.38	0.179	32.69
BR4	109	6586	107	226	234	266	185	153	235	3.47	0.057	12.28	2.66	0.022	12.28	10.92	0.217	37.53
DR	108	6268	102	1912	211	659	152	228	167	7.21	0.155	12.32	2.51	0.023	12.13	10.33	0.226	35.29
ENT	154	7662	105	855	1234	434	178	457	203	5.45	0.061	11.76	2.57	0.023	11.74	10.55	0.196	31.87
HAL	126	6514	129	700	853	373	494	297	632	5.00	0.050	11.97	2.50	0.019	11.98	10.36	0.193	33.37
KFA	105	6064	103	465	153	1627	159	452	178	15.55	0.486	12.93	2.50	0.021	11.99	10.28	0.182	30.18
LR	118	8057	102	1005	1525	471	151	186	168	5.73	0.076	11.94	2.45	0.019	11.88	10.15	0.191	27.91
MBA	114	12781	678	334	372	314	216	168	279	3.92	0.064	10.73	2.30	0.014	10.63	9.62	0.120	7.17
MBR	116	8299	1529	498	548	296	182	188	377	4.49	0.038	11.22	2.37	0.014	11.21	9.90	0.131	17.67

Table 13c - SIM2FLC zone 24-hr avg concentrations

	VOC1 (µg/m^3)	VOC2 (µg/m^3)	VOC3 (µg/m^3)	VOC4 (µg/m^3)	VOC5 (µg/m^3)	VOC6 (µg/m^3)	VOC7 (µg/m^3)	VOC8 (µg/m^3)	VOC9 (µg/m^3)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (µg/m^3)	CO.2 (PPM)	NO2.2 (PPM)	PART.2 (µg/m^3)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (µg/m^3)
BA2	285	7728	101	164	160	167	1336	121	163	2.22	0.011	10.17	1.61	0.006	10.13	6.79	0.056	3.47
BA3	110	8222	101	145	129	174	135	119	144	2.24	0.011	9.74	1.60	0.005	9.69	6.78	0.050	0.91
BR2	103	4375	100	116	108	128	113	110	117	1.87	0.013	11.35	1.60	0.010	11.33	6.76	0.101	19.84
BR3	103	4681	100	118	109	133	115	110	536	1.90	0.013	11.20	1.59	0.009	11.18	6.71	0.093	16.80
BR4	104	4581	100	122	116	134	116	108	123	1.92	0.013	11.23	1.61	0.010	11.21	6.78	0.095	17.01
DR	101	3657	99	237	110	189	108	120	111	2.33	0.024	11.72	1.58	0.011	11.65	6.68	0.114	25.71
ENT	106	4991	100	200	206	169	113	140	117	2.20	0.016	11.17	1.60	0.009	11.13	6.73	0.087	15.18
HAL	107	4770	101	173	177	153	126	123	173	2.10	0.015	11.24	1.61	0.009	11.21	6.78	0.092	16.50
KFA	102	4010	99	129	108	269	110	141	113	3.04	0.047	11.62	1.59	0.011	11.48	6.70	0.104	21.48
LR	103	4726	99	210	218	176	110	116	113	2.24	0.017	11.35	1.59	0.009	11.29	6.70	0.092	17.82
MBA	108	8309	189	158	154	163	128	119	158	2.20	0.010	10.09	1.61	0.005	10.05	6.81	0.053	3.03
MBR	106	6353	228	169	172	153	119	120	163	2.12	0.011	10.74	1.62	0.007	10.70	6.81	0.069	10.15

Table 13d - SIM2FLC zone 4-hr avg concentrations

	VOC1 (µg/m^3)	VOC2 (µg/m^3)	VOC3 (µg/m^3)	VOC4 (µg/m^3)	VOC5 (µg/m^3)	VOC6 (µg/m^3)	VOC7 (µg/m^3)	VOC8 (µg/m^3)	VOC9 (µg/m^3)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (µg/m^3)	CO.2 (PPM)	NO2.2 (PPM)	PART.2 (µg/m^3)
BA2	377	NA	103	258	272	221	4308	153	246	3.72	0.023	9.94	2.17	0.005	9.80
BA3	112	NA	103	169	157	208	144	140	156	3.63	0.023	9.06	2.12	0.003	8.92
BR2	102	NA	101	128	113	149	117	126	125	2.63	0.018	11.23	2.06	0.009	11.18
BR3	102	NA	101	128	115	155	121	124	1585	2.63	0.018	11.33	2.03	0.009	11.27
BR4	103	NA	101	126	116	150	120	118	128	2.76	0.019	11.22	2.10	0.009	11.16
DR	101	NA	100	528	115	420	111	161	115	5.11	0.068	11.85	1.98	0.011	11.52
ENT	104	NA	100	430	447	295	112	255	116	4.27	0.037	11.19	2.07	0.008	10.97
HAL	104	NA	103	347	364	239	129	186	310	3.88	0.030	11.11	2.10	0.008	10.93
KFA	101	NA	100	129	111	692	113	258	117	8.07	0.163	12.00	2.01	0.010	11.34
LR	101	NA	100	478	465	339	110	136	114	4.51	0.043	11.43	2.05	0.009	11.18
MBA	109	NA	404	232	246	204	132	142	226	3.51	0.020	9.82	2.18	0.004	9.70
MBR	105	NA	512	315	337	216	117	160	275	3.65	0.021	10.56	2.17	0.006	10.42

Table 13e - SIM2FLC zone 1-hr avg concentrations

	CO.1 (PPM)	CO.2 (PPM)
BA2	3.36	1.76
BA3	3.52	1.77
BR2	3.14	1.68
BR3	3.16	1.68
BR4	3.27	1.70
DR	4.98	1.66
ENT	3.40	1.71
HAL	3.23	1.71
KFA	11.90	1.68
LR	3.56	1.70
MBA	3.27	1.75
MBR	2.94	1.73

LEGEND

VOC1	Burst - CLO	CO.1	Oven
VOC2	Floor	NO2.1	Oven
VOC3	Burst - MBR	PART.1	Oven
VOC4	Burst - DR	CO.2	Heater
VOC5	Burst - LR	NO2.2	Heater
VOC6	Burst - KFA	PART.2	Heater
VOC7	Burst - BA2	CO.3	Outdoor air
VOC8	Burst - GAR	NO2.3	Outdoor air
VOC9	Burst - BR3	PART.3	Outdoor air

Table 14a - SIM2FLM overall 24-hr avg concentrations

	VOC1 (μg/m^3)	VOC2 (μg/m^3)	VOC3 (μg/m^3)	VOC4 (μg/m^3)	VOC5 (μg/m^3)	VOC6 (μg/m^3)	VOC7 (μg/m^3)	VOC8 (μg/m^3)	VOC9 (μg/m^3)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (μg/m^3)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (μg/m^3)
24 hr avg	681	7974	135	137	134	145	167	99	153	1.94	0.017	11.22	6.60	0.092	20.38

Table 14b - SIM2FLM zone peak concentrations

	VOC1 (μg/m^3)	VOC2 (μg/m^3)	VOC3 (μg/m^3)	VOC4 (μg/m^3)	VOC5 (μg/m^3)	VOC6 (μg/m^3)	VOC7 (μg/m^3)	VOC8 (μg/m^3)	VOC9 (μg/m^3)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (μg/m^3)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (μg/m^3)
BA2	278	8960	113	126	112	151	9768	102	139	3.19	0.078	12.22	11.20	0.189	33.01
BA3	626	21975	117	138	119	176	141	102	140	3.50	0.090	10.33	7.93	0.092	3.77
BR2	108	6493	221	121	110	142	238	101	203	2.86	0.064	12.13	10.73	0.186	31.16
BR3	109	7895	148	121	110	143	157	101	4174	2.95	0.068	12.21	10.13	0.185	36.96
BR4	108	5537	109	116	108	133	116	102	118	2.96	0.067	12.69	11.92	0.259	48.18
DR	190	8080	325	2301	841	145	358	102	244	3.43	0.071	12.20	10.56	0.203	35.67
ENT	209	7190	529	130	132	136	543	112	471	2.89	0.063	12.42	11.56	0.219	40.48
HAL	132	6320	621	118	119	129	648	105	542	2.86	0.056	12.53	11.56	0.238	43.68
KFA	182	11894	231	740	453	1685	260	110	155	16.60	0.539	12.47	9.53	0.184	34.16
LR	199	7409	396	132	1347	132	428	101	360	2.94	0.049	12.02	11.08	0.157	28.72
MBA	126	9771	114	124	112	148	123	102	137	3.18	0.078	12.42	11.61	0.213	37.42
MBR	123	7527	1323	113	114	123	126	102	160	2.87	0.039	12.40	11.62	0.206	35.81

Table 14c - SIM2FLM zone 24-hr avg concentrations

	VOC1 (μg/m^3)	VOC2 (μg/m^3)	VOC3 (μg/m^3)	VOC4 (μg/m^3)	VOC5 (μg/m^3)	VOC6 (μg/m^3)	VOC7 (μg/m^3)	VOC8 (μg/m^3)	VOC9 (μg/m^3)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (μg/m^3)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (μg/m^3)
BA2	152	5116	102	104	103	107	1270	99	107	1.72	0.012	11.31	6.58	0.089	18.41
BA3	388	13935	106	114	108	126	122	100	114	1.88	0.007	8.98	6.53	0.032	2.11
BR2	102	4340	120	102	100	104	134	99	113	1.67	0.011	11.59	6.66	0.099	21.35
BR3	102	4705	108	102	101	104	113	99	713	1.67	0.011	11.48	6.65	0.096	21.07
BR4	101	2719	100	100	100	102	102	99	101	1.64	0.015	12.09	6.56	0.131	33.23
DR	143	4960	135	268	188	108	157	99	118	1.75	0.012	11.46	6.65	0.089	17.98
ENT	159	3933	136	104	104	105	167	99	130	1.67	0.013	11.77	6.59	0.110	25.79
HAL	106	3449	138	103	102	104	170	99	138	1.65	0.014	11.89	6.58	0.118	29.31
KFA	134	6617	126	211	166	336	140	100	113	3.21	0.046	11.13	6.72	0.072	13.93
LR	154	4700	138	105	198	106	166	99	126	1.69	0.011	11.54	6.62	0.091	18.31
MBA	108	4838	103	103	102	105	106	99	106	1.70	0.012	11.43	6.57	0.095	20.56
MBR	105	4239	205	102	102	103	105	99	107	1.64	0.011	11.63	6.57	0.099	22.15

Table 14d - SIM2FLM zone 4-hr avg concentrations

	VOC1 (μg/m^3)	VOC2 (μg/m^3)	VOC3 (μg/m^3)	VOC4 (μg/m^3)	VOC5 (μg/m^3)	VOC6 (μg/m^3)	VOC7 (μg/m^3)	VOC8 (μg/m^3)	VOC9 (μg/m^3)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (μg/m^3)
BA2	106	NA	99	99	99	100	3223	98	100	2.00	0.012	12.06
BA3	601	NA	104	110	105	120	119	99	111	1.83	0.002	8.26
BR2	99	NA	174	99	99	99	197	98	101	2.07	0.010	11.72
BR3	99	NA	133	99	99	100	143	98	2006	2.05	0.009	11.35
BR4	98	NA	98	98	98	99	99	98	98	1.90	0.015	12.45
DR	184	NA	238	443	380	100	277	98	105	2.11	0.008	11.45
ENT	201	NA	237	99	99	99	292	98	100	1.95	0.014	12.22
HAL	99	NA	241	99	99	99	300	98	100	1.92	0.014	12.35
KFA	174	NA	196	480	350	697	218	99	113	8.79	0.175	11.16
LR	193	NA	244	99	346	99	291	98	102	2.05	0.010	11.81
MBA	100	NA	99	99	99	99	99	98	99	1.96	0.014	12.26
MBR	99	NA	377	99	99	99	99	98	99	1.97	0.013	12.23

Table 14e - SIM2FLM zone 1-hr avg concentrations

	CO.1 (PPM)
BA2	2.62
BA3	1.84
BR2	2.56
BR3	2.40
BR4	2.64
DR	2.49
ENT	2.66
HAL	2.62
KFA	13.76
LR	2.66
MBA	2.69
MBR	2.71

LEGEND

VOC1	Burst - CLO	CO.1	Oven
VOC2	Floor	NO2.1	Oven
VOC3	Burst - MBR	PART.1	Oven
VOC4	Burst - DR	CO.2	Heater
VOC5	Burst - LR	NO2.2	Heater
VOC6	Burst - KFA	PART.2	Heater
VOC7	Burst - BA2	CO.3	Outdoor air
VOC8	Burst - GAR	NO2.3	Outdoor air
VOC9	Burst - BR3	PART.3	Outdoor air

Table 15a - SIM2FLH overall 24-hr avg concentrations

	VOC1 (μg/m³)	VOC2 (μg/m³)	VOC3 (μg/m³)	VOC4 (μg/m³)	VOC5 (μg/m³)	VOC6 (μg/m³)	VOC7 (μg/m³)	VOC8 (μg/m³)	VOC9 (μg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (μg/m³)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (μg/m³)
24 hr avg	1441	13042	186	178	178	181	189	102	185	2.37	0.016	8.49	6.93	0.063	7.92

Table 15b - SIM2FLH zone peak concentrations

	VOC1 (μg/m³)	VOC2 (μg/m³)	VOC3 (μg/m³)	VOC4 (μg/m³)	VOC5 (μg/m³)	VOC6 (μg/m³)	VOC7 (μg/m³)	VOC8 (μg/m³)	VOC9 (μg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (μg/m³)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (μg/m³)
BA2	203	13237	406	404	373	456	7771	124	394	5.82	0.123	9.46	10.00	0.119	12.20
BA3	227	13888	429	436	397	489	469	124	420	6.30	0.138	9.04	9.93	0.102	1.05
BR2	188	12399	375	379	341	410	393	123	379	5.54	0.111	9.65	9.89	0.103	13.36
BR3	190	13589	404	399	366	438	424	123	3161	5.60	0.113	9.30	9.89	0.103	10.62
BR4	188	13277	403	397	365	437	422	122	382	5.30	0.107	9.82	10.00	0.131	16.86
DR	220	12860	381	1799	705	398	418	121	412	5.46	0.099	10.09	10.00	0.114	15.55
ENT	307	11544	414	381	343	411	485	129	472	5.47	0.108	10.68	10.32	0.168	26.90
HAL	180	12202	594	356	328	381	632	120	604	5.14	0.097	10.06	10.06	0.140	17.84
KFA	215	13914	388	631	553	1289	410	130	403	11.40	0.377	9.71	9.94	0.103	9.48
LR	246	12010	383	373	1402	398	425	121	420	5.47	0.097	10.51	10.02	0.135	22.72
MBA	187	13071	400	399	368	450	429	124	387	5.71	0.120	9.76	10.06	0.129	14.65
MBR	167	10972	1472	324	286	345	329	116	323	4.86	0.081	10.23	10.29	0.148	16.88

Table 15c - SIM2FLH zone 24-hr avg concentrations

	VOC1 (μg/m³)	VOC2 (μg/m³)	VOC3 (μg/m³)	VOC4 (μg/m³)	VOC5 (μg/m³)	VOC6 (μg/m³)	VOC7 (μg/m³)	VOC8 (μg/m³)	VOC9 (μg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (μg/m³)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (μg/m³)
BA2	167	9417	185	182	175	187	460	103	186	2.44	0.016	8.22	7.00	0.058	4.18
BA3	178	10006	193	189	182	195	198	103	194	2.52	0.016	7.87	7.03	0.050	0.55
BR2	161	9223	182	179	172	184	187	103	182	2.40	0.015	8.39	6.98	0.061	6.00
BR3	165	9845	187	184	177	189	192	103	312	2.45	0.015	8.08	6.99	0.053	3.16
BR4	163	9490	184	180	174	185	188	103	184	2.41	0.015	8.28	6.99	0.058	5.11
DR	182	9420	185	225	204	184	190	103	186	2.43	0.015	8.43	7.03	0.058	5.91
ENT	213	8485	184	173	166	178	188	103	184	2.35	0.016	8.86	6.99	0.073	10.88
HAL	156	8820	197	172	166	177	199	102	195	2.33	0.014	8.69	6.97	0.065	7.86
KFA	183	9966	188	204	195	219	193	104	189	2.76	0.027	8.19	7.04	0.051	3.23
LR	187	8980	183	176	219	181	188	103	184	2.39	0.015	8.67	7.03	0.065	8.55
MBA	162	9188	182	179	173	184	187	103	183	2.41	0.016	8.34	6.99	0.060	4.89
MBR	147	7850	226	161	156	165	167	102	164	2.23	0.014	9.25	6.96	0.075	12.09

Table 15d - SIM2FLH zone 4-hr avg concentrations

	VOC1 (μg/m³)	VOC2 (μg/m³)	VOC3 (μg/m³)	VOC4 (μg/m³)	VOC5 (μg/m³)	VOC6 (μg/m³)	VOC7 (μg/m³)	VOC8 (μg/m³)	VOC9 (μg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (μg/m³)
BA2	172	NA	273	281	253	297	1173	101	290	4.30	0.047	8.61
BA3	191	NA	290	300	268	317	312	101	309	4.57	0.051	8.18
BR2	167	NA	263	272	244	288	282	101	280	4.24	0.045	8.63
BR3	172	NA	274	282	254	297	292	101	685	4.27	0.045	8.54
BR4	169	NA	265	272	246	286	282	100	281	4.08	0.043	8.88
DR	197	NA	277	432	347	290	296	101	294	4.31	0.043	8.53
ENT	244	NA	289	263	236	278	306	100	306	4.10	0.043	8.95
HAL	161	NA	316	256	231	270	326	100	330	3.98	0.040	9.07
KFA	196	NA	281	351	313	403	302	101	300	5.33	0.084	8.45
LR	207	NA	278	267	404	284	297	101	295	4.23	0.042	8.70
MBA	169	NA	267	275	247	290	285	100	283	4.21	0.046	8.76
MBR	152	NA	436	233	211	246	241	100	239	3.75	0.036	9.48

Table 15e - SIM2FLH zone 1-hr avg concentrations

	CO.1 (PPM)
BA2	4.53
BA3	4.90
BR2	4.33
BR3	4.39
BR4	4.21
DR	4.16
ENT	4.22
HAL	3.99
KFA	7.74
LR	4.11
MBA	4.46
MBR	3.76

LEGEND

VOC1	Burst - CLO	CO.1	Oven
VOC2	Floor	NO2.1	Oven
VOC3	Burst - MBR	PART.1	Oven
VOC4	Burst - DR	CO.2	Heater
VOC5	Burst - LR	NO2.2	Heater
VOC6	Burst - KFA	PART.2	Heater
VOC7	Burst - BA2	CO.3	Outdoor air
VOC8	Burst - GAR	NO2.3	Outdoor air
VOC9	Burst - BR3	PART.3	Outdoor air

Table 16a - SIM2FTC overall 24-hr avg concentrations

	VOC1	VOC2	VOC3	VOC4	VOC5	VOC6	VOC7	VOC8	VOC9	CO.1	NO2.1	PART.1	CO.2	NO2.2	PART.2	CO.3	NO2.3	PART.3
	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(PPM)	(PPM)	(µg/m^3)	(PPM)	(PPM)	(µg/m^3)	(PPM)	(PPM)	(µg/m^3)
24 hr avg	2600	30356	214	337	322	325	278	204	300	3.41	0.017	7.89	1.62	0.004	7.82	6.49	0.034	5.24

Table 16b - SIM2FTC zone peak concentrations

	VOC1	VOC2	VOC3	VOC4	VOC5	VOC6	VOC7	VOC8	VOC9	CO.1	NO2.1	PART.1	CO.2	NO2.2	PART.2	CO.3	NO2.3	PART.3
	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(PPM)	(PPM)	(µg/m^3)	(PPM)	(PPM)	(µg/m^3)	(PPM)	(PPM)	(µg/m^3)
BA2	288	26390	224	420	401	510	13893	286	430	5.56	0.065	7.97	1.96	0.006	7.81	7.76	0.045	2.08
BA3	138	27089	230	431	358	542	421	288	432	5.98	0.075	8.07	1.95	0.007	7.88	7.67	0.049	0.48
BR2	119	19706	188	339	282	407	320	247	328	4.60	0.054	9.27	2.05	0.009	9.26	8.33	0.088	12.26
BR3	121	19400	196	361	298	434	340	261	5098	4.75	0.056	9.25	2.06	0.007	9.24	8.37	0.071	12.10
BR4	122	18977	201	371	311	443	349	264	361	4.82	0.056	9.64	2.11	0.010	9.68	8.69	0.095	15.85
DR	125	20469	175	3198	646	706	283	262	291	8.07	0.076	9.58	2.06	0.010	9.50	8.27	0.104	15.10
ENT	233	20894	197	834	1380	456	342	664	360	5.34	0.052	8.77	2.31	0.014	9.11	8.55	0.093	14.88
HAL	157	20719	351	628	1041	409	691	426	686	4.62	0.045	8.94	2.08	0.009	9.00	8.26	0.073	11.93
KFA	122	19654	181	663	419	2096	300	552	307	19.92	0.595	10.22	2.09	0.010	9.14	8.20	0.073	10.06
LR	142	23040	178	1089	2373	451	288	273	300	5.44	0.038	8.87	2.00	0.008	8.85	7.99	0.073	9.16
MBA	140	27016	745	410	366	502	396	280	411	5.47	0.065	7.98	1.95	0.006	7.81	7.77	0.045	2.42
MBR	147	25423	2050	374	579	385	351	273	402	4.26	0.034	8.10	1.98	0.005	8.02	7.87	0.046	4.78

Table 16c - SIM2FTC zone 24-hr avg concentrations

	VOC1	VOC2	VOC3	VOC4	VOC5	VOC6	VOC7	VOC8	VOC9	CO.1	NO2.1	PART.1	CO.2	NO2.2	PART.2	CO.3	NO2.3	PART.3
	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(PPM)	(PPM)	(µg/m^3)	(PPM)	(PPM)	(µg/m^3)	(PPM)	(PPM)	(µg/m^3)
BA2	194	20782	170	307	287	326	2335	206	296	3.35	0.009	7.18	1.64	0.002	7.14	6.57	0.019	0.57
BA3	120	20431	171	310	277	337	275	207	287	3.45	0.010	7.16	1.64	0.002	7.11	6.55	0.020	0.24
BR2	111	15821	148	242	219	259	218	174	229	2.87	0.009	8.53	1.63	0.004	8.50	6.65	0.043	7.42
BR3	112	16388	151	249	224	269	226	178	1034	2.97	0.009	8.38	1.64	0.004	8.34	6.66	0.039	6.15
BR4	113	16266	151	249	225	268	227	177	237	2.97	0.009	8.40	1.65	0.004	8.36	6.70	0.040	6.16
DR	112	15286	141	584	303	314	203	185	211	3.43	0.015	8.82	1.64	0.005	8.74	6.61	0.049	9.47
ENT	125	17436	152	353	443	284	227	273	241	3.06	0.009	8.10	1.71	0.004	8.16	6.59	0.035	5.23
HAL	119	17474	174	295	331	276	276	213	340	3.00	0.008	8.12	1.66	0.004	8.11	6.64	0.034	4.97
KFA	112	16002	144	327	264	515	210	247	219	5.24	0.056	8.76	1.69	0.004	8.54	6.62	0.041	7.01
LR	115	17655	147	429	569	290	216	191	226	3.15	0.009	8.18	1.64	0.004	8.15	6.58	0.034	5.35
MBA	124	21096	283	301	280	320	267	202	289	3.31	0.008	7.18	1.64	0.002	7.14	6.57	0.019	0.66
MBR	122	20388	459	290	304	287	254	200	298	3.04	0.006	7.47	1.65	0.002	7.45	6.60	0.023	2.72

Table 16d - SIM2FTC zone 4-hr avg concentrations

	VOC1	VOC2	VOC3	VOC4	VOC5	VOC6	VOC7	VOC8	VOC9	CO.1	NO2.1	PART.1	CO.2	NO2.2	PART.2
	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(PPM)	(PPM)	(µg/m^3)	(PPM)	(PPM)	(µg/m^3)
BA2	232	NA	174	329	346	367	7259	241	343	3.94	0.019	6.70	1.93	0.001	6.65
BA3	122	NA	177	328	304	393	302	240	316	4.24	0.022	6.59	1.92	0.001	6.52
BR2	110	NA	147	238	221	278	226	187	236	3.31	0.016	8.41	1.96	0.004	8.37
BR3	110	NA	149	239	222	285	231	189	2892	3.38	0.017	8.52	1.96	0.004	8.47
BR4	110	NA	148	234	218	279	228	185	237	3.44	0.017	8.56	2.01	0.004	8.50
DR	110	NA	138	1455	339	528	201	221	209	5.97	0.049	8.90	1.96	0.004	8.60
ENT	123	NA	146	555	881	317	219	472	230	3.70	0.018	7.88	2.04	0.003	7.91
HAL	118	NA	182	391	590	295	304	304	500	3.51	0.015	7.76	2.01	0.003	7.77
KFA	110	NA	141	365	269	1251	210	410	218	13.89	0.230	9.45	2.04	0.004	8.36
LR	114	NA	142	817	1235	359	211	213	220	4.07	0.020	7.96	1.95	0.003	7.88
MBA	128	NA	517	314	319	358	284	229	325	3.83	0.018	6.69	1.92	0.001	6.64
MBR	124	NA	1040	324	427	294	251	239	360	3.25	0.011	7.09	1.95	0.002	7.09

Table 16e - SIM2FTC zone 1-hr avg concentrations

	CO.1	CO.2
	(PPM)	(PPM)
BA2	3.46	1.54
BA3	3.67	1.54
BR2	3.13	1.56
BR3	3.18	1.54
BR4	3.23	1.53
DR	3.70	1.56
ENT	3.13	1.60
HAL	3.07	1.56
KFA	13.79	1.58
LR	2.96	1.56
MBA	3.44	1.53
MBR	2.91	1.52

LEGEND

VOC1	Burst - CLO	CO.1	Oven
VOC2	Floor	NO2.1	Oven
VOC3	Burst - MBR	PART.1	Oven
VOC4	Burst - DR	CO.2	Heater
VOC5	Burst - LR	NO2.2	Heater
VOC6	Burst - KFA	PART.2	Heater
VOC7	Burst - BA2	CO.3	Outdoor air
VOC8	Burst - GAR	NO2.3	Outdoor air
VOC9	Burst - BR3	PART.3	Outdoor air

Table 17a - SIM2FTM overall 24-hr avg concentrations

	VOC1 (µg/m³)	VOC2 (µg/m³)	VOC3 (µg/m³)	VOC4 (µg/m³)	VOC5 (µg/m³)	VOC6 (µg/m³)	VOC7 (µg/m³)	VOC8 (µg/m³)	VOC9 (µg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (µg/m³)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (µg/m³)
24 hr avg	1828	23498	213	222	228	211	282	106	272	2.59	0.015	9.13	6.78	0.044	8.64

Table 17b - SIM2FTM zone peak concentrations

	VOC1 (µg/m³)	VOC2 (µg/m³)	VOC3 (µg/m³)	VOC4 (µg/m³)	VOC5 (µg/m³)	VOC6 (µg/m³)	VOC7 (µg/m³)	VOC8 (µg/m³)	VOC9 (µg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (µg/m³)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (µg/m³)
BA2	236	21076	173	238	208	235	12903	124	249	3.87	0.078	10.69	9.43	0.097	15.49
BA3	888	36409	197	281	243	279	298	124	297	4.18	0.090	8.47	7.22	0.033	1.31
BR2	150	17017	216	216	191	215	252	117	246	3.32	0.062	10.02	8.78	0.082	11.93
BR3	150	18630	166	223	196	221	232	118	5374	3.43	0.066	9.87	8.47	0.074	14.95
BR4	148	16245	155	205	181	202	209	118	211	3.42	0.066	11.66	10.11	0.133	24.68
DR	287	18501	387	2777	984	250	345	120	321	3.29	0.053	9.67	8.96	0.087	14.37
ENT	328	19333	779	213	283	205	553	171	443	3.39	0.060	11.37	10.12	0.113	19.59
HAL	207	18377	934	187	205	186	638	141	490	3.19	0.051	11.60	10.22	0.133	22.69
KFA	264	25048	259	860	528	1911	309	155	290	19.69	0.591	10.07	8.29	0.067	11.83
LR	303	18320	501	224	1953	189	411	120	346	3.10	0.042	10.41	9.37	0.059	8.94
MBA	166	20691	182	223	196	220	229	122	235	3.87	0.078	11.73	10.52	0.140	22.45
MBR	168	19681	1698	174	179	168	224	122	282	2.98	0.038	11.72	10.54	0.135	21.07

Table 17c - SIM2FTM zone 24-hr avg concentrations

	VOC1 (µg/m³)	VOC2 (µg/m³)	VOC3 (µg/m³)	VOC4 (µg/m³)	VOC5 (µg/m³)	VOC6 (µg/m³)	VOC7 (µg/m³)	VOC8 (µg/m³)	VOC9 (µg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (µg/m³)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (µg/m³)
BA2	156	14281	139	154	150	152	3166	106	175	2.23	0.008	9.22	6.97	0.043	7.99
BA3	557	26445	168	204	193	203	236	111	227	2.55	0.006	6.88	6.55	0.013	0.69
BR2	127	14220	165	145	141	144	191	104	165	2.11	0.007	9.26	6.88	0.043	7.99
BR3	129	15092	140	150	145	149	171	105	1655	2.13	0.007	9.07	6.76	0.042	8.05
BR4	119	9904	122	132	130	131	143	103	140	2.00	0.009	10.27	6.86	0.067	14.55
DR	229	15696	225	503	388	156	244	106	185	2.24	0.006	9.01	6.95	0.032	5.29
ENT	268	12081	262	143	154	137	281	110	192	2.07	0.008	9.87	6.97	0.054	10.45
HAL	135	10890	259	136	139	133	288	106	228	2.03	0.008	10.08	6.94	0.061	13.05
KFA	210	19163	191	416	306	558	224	112	193	5.28	0.054	8.54	6.78	0.024	3.70
LR	252	14696	254	155	410	145	270	106	188	2.14	0.005	9.24	7.01	0.033	5.02
MBA	131	11236	135	139	137	138	156	105	156	2.10	0.009	9.94	6.97	0.057	11.47
MBR	130	10736	343	130	132	128	151	104	159	1.98	0.008	10.07	6.98	0.058	11.56

Table 17d - SIM2FTM zone 4-hr avg concentrations

	VOC1 (µg/m³)	VOC2 (µg/m³)	VOC3 (µg/m³)	VOC4 (µg/m³)	VOC5 (µg/m³)	VOC6 (µg/m³)	VOC7 (µg/m³)	VOC8 (µg/m³)	VOC9 (µg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (µg/m³)
BA2	120	NA	114	120	119	120	7479	101	128	2.07	0.007	10.52
BA3	864	NA	160	193	182	190	223	108	216	2.11	0.001	6.42
BR2	113	NA	199	120	118	119	196	101	132	2.05	0.005	9.74
BR3	117	NA	142	128	125	127	155	101	3786	2.03	0.004	9.18
BR4	104	NA	104	107	106	107	110	99	109	2.07	0.009	11.21
DR	281	NA	312	1061	770	119	282	101	143	2.07	0.002	9.43
ENT	316	NA	505	107	108	107	440	100	117	2.11	0.008	11.17
HAL	106	NA	524	105	105	105	467	99	113	2.08	0.009	11.41
KFA	260	NA	204	753	447	1189	222	104	174	13.18	0.226	9.12
LR	298	NA	415	114	825	112	355	101	130	2.14	0.004	10.23
MBA	107	NA	106	107	107	107	111	100	111	2.08	0.010	11.54
MBR	106	NA	697	103	104	103	107	99	107	2.09	0.009	11.52

Table 17e - SIM2FTM zone 1 hr avg concentrations

	CO.1 (PPM)
BA2	2.29
BA3	2.12
BR2	2.13
BR3	2.11
BR4	2.41
DR	1.90
ENT	2.43
HAL	2.45
KFA	15.11
LR	2.11
MBA	2.52
MBR	2.52

LEGEND

VOC1	Burst - CLO	CO.1	Oven
VOC2	Floor	NO2.1	Oven
VOC3	Burst - MBR	PART.1	Oven
VOC4	Burst - DR	CO.2	Heater
VOC5	Burst - LR	NO2.2	Heater
VOC6	Burst - KFA	PART.2	Heater
VOC7	Burst - BA2	CO.3	Outdoor air
VOC8	Burst - GAR	NO2.3	Outdoor air
VOC9	Burst - BR3	PART.3	Outdoor air

Table 18a - SIM2FTH overall 24-hr avg concentrations

	VOC1 (μg/m³)	VOC2 (μg/m³)	VOC3 (μg/m³)	VOC4 (μg/m³)	VOC5 (μg/m³)	VOC6 (μg/m³)	VOC7 (μg/m³)	VOC8 (μg/m³)	VOC9 (μg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (μg/m³)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (μg/m³)
24 hr avg	3979	39385	370	359	360	359	369	122	367	3.92	0.015	4.94	7.00	0.024	2.89

Table 18b - SIM2FTH zone peak concentrations

	VOC1 (μg/m³)	VOC2 (μg/m³)	VOC3 (μg/m³)	VOC4 (μg/m³)	VOC5 (μg/m³)	VOC6 (μg/m³)	VOC7 (μg/m³)	VOC8 (μg/m³)	VOC9 (μg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (μg/m³)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (μg/m³)
BA2	312	34060	599	624	583	663	8491	168	613	6.70	0.136	5.57	8.16	0.044	4.12
BA3	339	34237	615	638	596	690	662	168	628	7.03	0.147	5.34	8.16	0.035	0.28
BR2	311	33445	579	599	563	619	613	166	589	6.41	0.121	5.48	8.12	0.036	3.88
BR3	312	34488	594	616	579	638	630	166	3636	6.44	0.124	5.56	8.11	0.036	3.17
BR4	311	34373	594	615	579	637	629	165	605	6.36	0.123	5.84	8.14	0.046	4.98
DR	337	33619	579	2102	929	597	600	168	583	6.29	0.105	5.75	8.15	0.039	5.26
ENT	518	32782	597	599	567	613	632	187	610	6.49	0.121	6.54	8.37	0.072	12.24
HAL	304	33496	774	579	547	598	850	163	808	6.20	0.108	6.03	8.29	0.051	5.75
KFA	331	34270	582	856	732	1464	605	180	587	12.35	0.399	5.95	8.14	0.035	2.93
LR	356	32917	579	579	1773	595	601	170	585	6.31	0.102	6.16	8.16	0.045	8.50
MBA	310	33730	590	614	572	655	626	168	604	6.57	0.132	6.12	8.37	0.055	5.89
MBR	290	32125	1739	525	506	545	538	158	523	5.77	0.089	6.53	8.55	0.057	6.32

Table 18c - SIM2FTH zone 24-hr avg concentrations

	VOC1 (μg/m³)	VOC2 (μg/m³)	VOC3 (μg/m³)	VOC4 (μg/m³)	VOC5 (μg/m³)	VOC6 (μg/m³)	VOC7 (μg/m³)	VOC8 (μg/m³)	VOC9 (μg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (μg/m³)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (μg/m³)
BA2	290	29482	386	380	374	384	678	125	387	4.18	0.015	4.55	7.17	0.020	1.24
BA3	299	29983	393	386	380	391	397	125	393	4.24	0.016	4.38	7.18	0.017	0.14
BR2	286	29446	384	377	371	382	388	124	384	4.15	0.014	4.61	7.16	0.021	1.66
BR3	290	29938	389	382	376	386	393	125	524	4.20	0.014	4.47	7.18	0.018	0.89
BR4	288	29667	386	379	373	384	390	125	386	4.17	0.014	4.55	7.18	0.020	1.36
DR	304	29545	383	426	405	380	388	125	384	4.14	0.013	4.65	7.18	0.020	1.63
ENT	340	28088	375	364	358	368	379	126	375	4.04	0.015	5.03	7.15	0.028	4.04
HAL	280	28835	398	368	362	372	399	124	396	4.06	0.013	4.82	7.16	0.022	2.12
KFA	306	30058	388	402	396	416	392	126	388	4.50	0.027	4.55	7.18	0.017	0.85
LR	309	29031	379	370	425	375	383	125	379	4.10	0.013	4.81	7.17	0.023	2.58
MBA	284	28852	379	372	366	377	383	124	379	4.11	0.015	4.72	7.16	0.022	1.65
MBR	266	27114	427	346	340	350	356	122	352	3.86	0.012	5.34	7.13	0.027	3.78

Table 18d - SIM2FTH zone 4-hr avg concentrations

	VOC1 (μg/m³)	VOC2 (μg/m³)	VOC3 (μg/m³)	VOC4 (μg/m³)	VOC5 (μg/m³)	VOC6 (μg/m³)	VOC7 (μg/m³)	VOC8 (μg/m³)	VOC9 (μg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (μg/m³)
BA2	294	NA	478	483	458	495	1448	126	490	5.63	0.053	5.15
BA3	308	NA	491	496	470	508	508	126	503	5.78	0.056	4.92
BR2	291	NA	469	475	449	487	486	125	481	5.56	0.050	5.13
BR3	295	NA	477	483	457	495	494	126	936	5.59	0.051	5.09
BR4	292	NA	473	478	453	490	489	125	484	5.53	0.050	5.25
DR	319	NA	473	646	565	485	490	126	484	5.53	0.047	5.04
ENT	374	NA	485	466	441	478	498	125	493	5.47	0.050	5.35
HAL	283	NA	534	457	433	469	533	125	531	5.35	0.046	5.47
KFA	318	NA	478	552	525	599	494	127	489	6.57	0.091	5.07
LR	328	NA	473	467	645	480	489	126	483	5.49	0.046	5.13
MBA	288	NA	466	471	446	482	481	125	477	5.51	0.052	5.39
MBR	267	NA	665	423	400	434	432	123	427	5.03	0.041	5.98

Table 18e - SIM2FTH zone 1-hr avg concentrations

	CO.1 (PPM)
BA2	5.11
BA3	5.37
BR2	4.84
BR3	4.91
BR4	4.85
DR	4.55
ENT	4.80
HAL	4.53
KFA	8.39
LR	4.51
MBA	5.02
MBR	4.17

LEGEND

VOC1	Burst - CLO	CO.1	Oven
VOC2	Floor	NO2.1	Oven
VOC3	Burst - MBR	PART.1	Oven
VOC4	Burst - DR	CO.2	Heater
VOC5	Burst - LR	NO2.2	Heater
VOC6	Burst - KFA	PART.2	Heater
VOC7	Burst - BA2	CO.3	Outdoor air
VOC8	Burst - GAR	NO2.3	Outdoor air
VOC9	Burst - BR3	PART.3	Outdoor air

Table 19a - SIM2MLC overall 24-hr avg concentrations

	VOC1 ($\mu g/m^3$)	VOC2 ($\mu g/m^3$)	VOC3 ($\mu g/m^3$)	VOC4 ($\mu g/m^3$)	VOC5 ($\mu g/m^3$)	VOC6 ($\mu g/m^3$)	VOC7 ($\mu g/m^3$)	VOC8 ($\mu g/m^3$)	VOC9 ($\mu g/m^3$)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 ($\mu g/m^3$)	CO.2 (PPM)	NO2.2 (PPM)	PART.2 ($\mu g/m^3$)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 ($\mu g/m^3$)
24 hr avg	248	3586	115	126	124	128	116	141	121	1.86	0.018	10.67	1.76	0.019	10.92	6.73	0.114	16.48

Table 19b - SIM2MLC zone peak concentrations

	VOC1 ($\mu g/m^3$)	VOC2 ($\mu g/m^3$)	VOC3 ($\mu g/m^3$)	VOC4 ($\mu g/m^3$)	VOC5 ($\mu g/m^3$)	VOC6 ($\mu g/m^3$)	VOC7 ($\mu g/m^3$)	VOC8 ($\mu g/m^3$)	VOC9 ($\mu g/m^3$)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 ($\mu g/m^3$)	CO.2 (PPM)	NO2.2 (PPM)	PART.2 ($\mu g/m^3$)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 ($\mu g/m^3$)
BA2	993	3319	229	308	296	320	3491	313	300	4.46	0.082	10.48	3.18	0.110	12.31	10.70	0.161	9.57
BA3	1021	3448	234	317	304	330	206	314	308	4.52	0.086	10.45	3.20	0.114	12.38	10.70	0.163	1.85
BR2	845	2903	206	272	261	281	185	276	265	4.12	0.071	11.83	2.91	0.093	12.38	10.93	0.188	34.86
BR3	943	3285	217	298	295	303	240	309	1593	4.35	0.077	11.23	3.09	0.102	12.28	10.71	0.183	24.45
BR4	916	3133	214	302	307	301	286	316	278	4.33	0.076	11.12	3.05	0.100	12.29	10.77	0.179	21.04
DR	665	2134	180	861	222	407	164	326	225	5.31	0.128	12.06	2.79	0.075	12.48	11.36	0.241	40.54
ENT	710	2188	183	401	444	303	167	390	241	4.00	0.071	11.67	2.79	0.077	12.45	11.36	0.229	34.30
HAL	751	2472	186	350	404	285	699	383	339	4.04	0.068	11.51	2.75	0.079	12.40	11.23	0.213	31.13
KFA	748	2407	191	247	238	758	173	620	242	8.91	0.271	11.73	2.76	0.083	12.58	10.94	0.222	32.26
LR	649	2171	175	484	683	322	162	273	218	4.18	0.079	11.84	2.79	0.071	12.48	11.37	0.229	33.88
MBA	993	3548	231	308	296	320	214	312	300	4.46	0.082	10.46	3.18	0.110	12.31	10.68	0.159	7.44
MBR	801	2845	742	285	305	271	374	316	292	3.98	0.063	11.20	2.84	0.082	12.27	10.90	0.173	20.45

Table 19c - SIM2MLC zone 24-hr avg concentrations

	VOC1 ($\mu g/m^3$)	VOC2 ($\mu g/m^3$)	VOC3 ($\mu g/m^3$)	VOC4 ($\mu g/m^3$)	VOC5 ($\mu g/m^3$)	VOC6 ($\mu g/m^3$)	VOC7 ($\mu g/m^3$)	VOC8 ($\mu g/m^3$)	VOC9 ($\mu g/m^3$)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 ($\mu g/m^3$)	CO.2 (PPM)	NO2.2 (PPM)	PART.2 ($\mu g/m^3$)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 ($\mu g/m^3$)
BA2	309	2761	113	127	125	128	289	142	123	1.85	0.015	10.14	1.81	0.020	10.47	6.75	0.098	3.22
BA3	320	2700	114	127	126	129	112	142	124	1.86	0.016	10.03	1.83	0.020	10.38	6.75	0.097	1.38
BR2	260	2306	110	120	119	121	109	133	118	1.81	0.016	10.70	1.78	0.020	10.98	6.75	0.116	14.77
BR3	285	2517	112	123	122	125	112	139	194	1.84	0.016	10.46	1.80	0.020	10.77	6.76	0.107	9.97
BR4	282	2528	112	124	123	125	114	140	120	1.83	0.016	10.47	1.79	0.020	10.77	6.75	0.107	9.64
DR	218	1787	107	145	113	126	106	135	113	1.85	0.021	11.31	1.73	0.021	11.52	6.73	0.137	26.55
ENT	233	1988	108	126	130	121	107	145	114	1.78	0.017	11.08	1.74	0.021	11.33	6.71	0.127	21.04
HAL	243	2222	109	125	127	122	132	144	119	1.79	0.016	10.92	1.75	0.020	11.18	6.72	0.118	17.47
KFA	239	2018	108	117	116	148	107	160	115	2.05	0.029	11.05	1.77	0.022	11.30	6.74	0.124	19.83
LR	219	1942	107	131	138	122	106	129	113	1.80	0.019	11.24	1.72	0.019	11.44	6.72	0.132	24.41
MBA	310	2862	116	127	125	129	113	141	123	1.86	0.015	10.10	1.82	0.020	10.44	6.75	0.096	2.77
MBR	261	2624	140	124	124	123	121	140	120	1.81	0.015	10.62	1.77	0.018	10.90	6.73	0.105	12.00

Table 19d - SIM2MLC zone 4-hr avg concentrations

	VOC1 ($\mu g/m^3$)	VOC2 ($\mu g/m^3$)	VOC3 ($\mu g/m^3$)	VOC4 ($\mu g/m^3$)	VOC5 ($\mu g/m^3$)	VOC6 ($\mu g/m^3$)	VOC7 ($\mu g/m^3$)	VOC8 ($\mu g/m^3$)	VOC9 ($\mu g/m^3$)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 ($\mu g/m^3$)	CO.2 (PPM)	NO2.2 (PPM)	PART.2 ($\mu g/m^3$)
BA2	644	NA	142	176	172	181	531	251	165	3.05	0.033	9.98	1.84	0.022	10.50
BA3	675	NA	143	178	174	184	139	250	168	3.09	0.034	9.87	1.83	0.021	10.39
BR2	554	NA	135	163	159	167	131	220	155	2.84	0.030	10.45	1.79	0.021	11.01
BR3	619	NA	140	175	172	179	145	249	340	3.02	0.032	10.06	1.80	0.021	10.89
BR4	596	NA	138	174	172	176	151	254	160	2.99	0.032	10.17	1.81	0.022	10.86
DR	426	NA	125	216	142	178	122	242	139	2.99	0.044	11.15	1.85	0.027	11.68
ENT	434	NA	125	170	176	159	122	282	140	2.71	0.032	11.05	1.92	0.032	11.51
HAL	460	NA	128	170	175	162	200	274	144	2.77	0.031	10.85	1.90	0.029	11.31
KFA	482	NA	129	152	149	232	125	357	146	3.85	0.077	10.86	1.95	0.035	11.67
LR	415	NA	124	186	198	163	121	211	138	2.76	0.034	11.16	1.83	0.024	11.50
MBA	648	NA	145	177	173	182	140	249	166	3.06	0.033	9.94	1.83	0.021	10.46
MBR	516	NA	208	168	169	167	164	248	151	2.85	0.029	10.50	1.86	0.024	10.97

Table 19e - SIM2MLC zone 1-hr avg concentrations

	CO.1 (PPM)	CO.2 (PPM)
BA2	4.00	1.89
BA3	4.12	1.88
BR2	3.70	1.80
BR3	3.92	1.81
BR4	3.90	1.83
DR	4.71	1.78
ENT	3.69	1.89
HAL	3.67	1.88
KFA	7.57	1.87
LR	3.91	1.79
MBA	3.99	1.89
MBR	3.60	1.90

LEGEND

VOC1	Burst - BMT	CO.1	Oven
VOC2	Floor	NO2.1	Oven
VOC3	Burst - MBR	PART.1	Oven
VOC4	Burst - DR	CO.2	Heater
VOC5	Burst - LR	NO2.2	Heater
VOC6	Burst - KFA	PART.2	Heater
VOC7	Burst - BA2	CO.3	Outdoor air
VOC8	Burst - GAR	NO2.3	Outdoor air
VOC9	Burst - BR3	PART.3	Outdoor air

Table 20a - SIM2MLM overall 24-hr avg concentrations

	VOC1 (µg/m³)	VOC2 (µg/m³)	VOC3 (µg/m³)	VOC4 (µg/m³)	VOC5 (µg/m³)	VOC6 (µg/m³)	VOC7 (µg/m³)	VOC8 (µg/m³)	VOC9 (µg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (µg/m³)	CO.2 (PPM)	NO2.2 (PPM)	PART.2 (µg/m³)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (µg/m³)
24 hr avg	269	6490	129	125	116	136	127	159	126	1.88	0.017	10.76	1.82	0.017	11.12	6.60	0.095	19.19

Table 20b - SIM2MLM zone peak concentrations

	VOC1 (µg/m³)	VOC2 (µg/m³)	VOC3 (µg/m³)	VOC4 (µg/m³)	VOC5 (µg/m³)	VOC6 (µg/m³)	VOC7 (µg/m³)	VOC8 (µg/m³)	VOC9 (µg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (µg/m³)	CO.2 (PPM)	NO2.2 (PPM)	PART.2 (µg/m³)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (µg/m³)
BA2	1046	4254	246	247	793	280	3371	334	277	3.13	0.037	11.51	3.03	0.098	13.39	9.84	0.122	20.92
BA3	1093	7502	251	260	267	296	251	308	293	3.21	0.039	10.68	3.10	0.101	13.20	9.89	0.130	3.28
BR2	852	5415	257	218	253	246	667	271	242	2.87	0.034	12.27	2.85	0.087	13.46	10.93	0.191	37.26
BR3	905	5851	244	225	251	257	543	282	4128	2.96	0.035	11.94	2.87	0.088	13.42	10.67	0.156	27.11
BR4	820	3792	215	222	228	250	233	245	248	2.90	0.037	12.56	2.86	0.086	13.40	11.59	0.243	46.16
DR	823	5659	204	2591	344	633	206	350	229	3.60	0.056	12.45	2.68	0.068	12.97	10.91	0.171	40.51
ENT	1005	3797	252	178	241	216	804	515	195	2.73	0.035	12.61	2.72	0.088	14.33	11.08	0.241	50.78
HAL	630	3798	410	176	416	189	1610	287	189	2.87	0.030	12.46	2.87	0.083	14.22	11.61	0.266	45.96
KFA	802	4961	204	213	215	1731	203	1337	235	15.68	0.501	12.54	4.01	0.131	14.54	10.54	0.128	19.57
LR	735	3996	213	238	876	203	516	353	187	2.79	0.034	12.62	2.77	0.050	13.03	11.25	0.226	46.09
MBA	1010	6354	362	247	254	281	238	292	278	3.14	0.037	11.68	2.94	0.093	13.27	9.92	0.122	24.00
MBR	641	5708	1704	178	188	208	248	223	195	2.64	0.029	12.42	2.60	0.059	13.14	10.67	0.172	39.94

Table 20c - SIM2MLM zone 24-hr avg concentrations

	VOC1 (µg/m³)	VOC2 (µg/m³)	VOC3 (µg/m³)	VOC4 (µg/m³)	VOC5 (µg/m³)	VOC6 (µg/m³)	VOC7 (µg/m³)	VOC8 (µg/m³)	VOC9 (µg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (µg/m³)	CO.2 (PPM)	NO2.2 (PPM)	PART.2 (µg/m³)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (µg/m³)
BA2	289	2680	112	112	135	113	271	140	110	1.74	0.009	10.11	1.89	0.015	10.61	6.57	0.066	6.83
BA3	438	5335	127	125	119	137	123	156	130	1.82	0.008	9.61	1.96	0.014	10.18	6.64	0.053	1.14
BR2	286	3605	119	112	117	117	157	135	114	1.71	0.011	10.97	1.85	0.018	11.39	6.69	0.096	17.86
BR3	314	4050	119	114	116	121	147	138	341	1.73	0.010	10.70	1.87	0.017	11.15	6.66	0.085	13.59
BR4	240	2635	110	109	108	114	112	123	111	1.72	0.013	11.35	1.80	0.018	11.66	6.73	0.116	24.76
DR	295	3667	113	272	118	139	113	149	114	1.79	0.012	10.89	1.78	0.014	11.19	6.59	0.090	16.55
ENT	308	1997	111	106	107	108	125	153	106	1.66	0.014	11.57	1.87	0.027	12.07	6.69	0.131	33.42
HAL	238	2505	120	107	119	109	188	129	107	1.66	0.014	11.68	1.83	0.024	12.09	6.71	0.133	33.56
KFA	292	4065	114	115	110	236	112	289	117	2.81	0.044	10.62	1.98	0.023	11.21	6.61	0.070	9.18
LR	263	2283	109	109	142	108	119	138	106	1.68	0.013	11.47	1.72	0.015	11.67	6.66	0.119	27.67
MBA	329	4271	130	117	112	125	116	137	120	1.74	0.009	10.12	1.85	0.013	10.55	6.56	0.065	6.61
MBR	214	3326	206	107	105	111	109	118	109	1.68	0.011	11.13	1.77	0.015	11.42	6.64	0.100	21.05

Table 20d - SIM2MLM zone 4-hr avg concentrations

	VOC1 (µg/m³)	VOC2 (µg/m³)	VOC3 (µg/m³)	VOC4 (µg/m³)	VOC5 (µg/m³)	VOC6 (µg/m³)	VOC7 (µg/m³)	VOC8 (µg/m³)	VOC9 (µg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (µg/m³)	CO.2 (PPM)	NO2.2 (PPM)	PART.2 (µg/m³)
BA2	430	NA	117	119	175	124	487	183	122	2.27	0.014	10.82	1.96	0.022	10.20
BA3	660	NA	165	170	169	190	166	201	182	2.59	0.014	10.06	1.92	0.019	9.82
BR2	432	NA	133	131	152	140	275	180	136	2.15	0.015	11.58	2.01	0.028	11.11
BR3	458	NA	136	134	152	144	249	179	547	2.21	0.015	11.44	1.98	0.025	10.75
BR4	394	NA	128	130	134	138	147	155	135	2.20	0.017	11.75	1.84	0.020	11.14
DR	412	NA	126	475	178	139	130	178	134	2.18	0.015	11.67	1.96	0.024	10.60
ENT	536	NA	109	109	110	112	119	225	111	1.92	0.017	12.22	2.31	0.062	12.60
HAL	390	NA	122	115	148	119	335	176	118	1.95	0.017	12.17	2.12	0.044	12.26
KFA	384	NA	131	142	135	395	132	606	141	6.32	0.146	11.55	2.83	0.078	12.38
LR	374	NA	109	109	193	112	115	176	111	1.97	0.017	12.25	1.88	0.022	11.37
MBA	443	NA	207	145	145	157	148	162	152	2.25	0.014	10.91	1.91	0.019	10.04
MBR	229	NA	311	116	117	120	128	124	119	2.02	0.016	11.96	1.93	0.023	11.12

Table 20e - SIM2MLM zone 1-hr avg concentrations

	CO.1 (PPM)	CO.2 (PPM)
BA2	2.44	2.17
BA3	2.50	2.15
BR2	2.59	2.23
BR3	2.60	2.21
BR4	2.66	1.92
DR	2.64	2.20
ENT	2.40	2.57
HAL	2.47	2.27
KFA	13.01	3.52
LR	2.55	1.95
MBA	2.45	2.12
MBR	2.52	2.07

LEGEND

VOC1	Burst - BMT	CO.1	Oven
VOC2	Floor	NO2.1	Oven
VOC3	Burst - MBR	PART.1	Oven
VOC4	Burst - DR	CO.2	Heater
VOC5	Burst - LR	NO2.2	Heater
VOC6	Burst - KFA	PART.2	Heater
VOC7	Burst - BA2	CO.3	Outdoor air
VOC8	Burst - GAR	NO2.3	Outdoor air
VOC9	Burst - BR3	PART.3	Outdoor air

Table 21a - SIM2MLH overall 24-hr avg concentrations

	VOC1 (µg/m³)	VOC2 (µg/m³)	VOC3 (µg/m³)	VOC4 (µg/m³)	VOC5 (µg/m³)	VOC6 (µg/m³)	VOC7 (µg/m³)	VOC8 (µg/m³)	VOC9 (µg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (µg/m³)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (µg/m³)
24 hr avg	284	7364	123	125	134	127	128	132	123	1.87	0.017	10.73	6.71	0.097	17.87

Table 21b - SIM2MLH zone peak concentrations

	VOC1 (µg/m³)	VOC2 (µg/m³)	VOC3 (µg/m³)	VOC4 (µg/m³)	VOC5 (µg/m³)	VOC6 (µg/m³)	VOC7 (µg/m³)	VOC8 (µg/m³)	VOC9 (µg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (µg/m³)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (µg/m³)
BA2	1022	9242	253	268	323	282	10646	272	289	4.19	0.069	10.58	10.45	0.134	16.10
BA3	1066	17117	261	276	334	291	234	266	297	4.33	0.074	10.44	10.44	0.138	2.13
BR2	926	6416	233	242	288	253	373	280	260	3.86	0.058	11.50	10.55	0.148	23.34
BR3	943	7141	238	244	292	257	366	276	3512	3.94	0.061	11.34	10.53	0.138	22.21
BR4	924	6545	236	239	285	251	413	276	257	3.89	0.060	11.59	10.58	0.146	25.75
DR	768	9781	209	1906	879	231	194	219	237	3.69	0.052	11.86	10.77	0.157	30.02
ENT	787	3931	177	184	212	191	164	474	194	3.14	0.048	12.34	11.57	0.268	49.47
HAL	799	4500	251	200	231	206	1479	418	211	3.31	0.044	12.06	11.13	0.229	43.53
KFA	885	9414	221	451	295	1576	210	800	252	14.55	0.481	11.64	10.56	0.130	12.44
LR	568	5276	172	179	1503	186	163	204	190	3.12	0.043	12.38	11.28	0.223	42.09
MBA	991	10210	568	268	323	282	227	253	289	4.19	0.069	10.93	10.48	0.134	16.37
MBR	618	5028	1430	191	222	199	176	196	204	3.27	0.044	12.08	10.88	0.192	36.85

Table 21c - SIM2MLH zone 24-hr avg concentrations

	VOC1 (µg/m³)	VOC2 (µg/m³)	VOC3 (µg/m³)	VOC4 (µg/m³)	VOC5 (µg/m³)	VOC6 (µg/m³)	VOC7 (µg/m³)	VOC8 (µg/m³)	VOC9 (µg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (µg/m³)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (µg/m³)
BA2	399	4987	118	121	130	124	547	133	122	1.84	0.011	10.17	6.81	0.072	5.46
BA3	517	7162	127	131	145	136	128	148	133	2.08	0.010	9.06	7.27	0.057	1.22
BR2	338	3694	114	116	123	118	127	128	117	1.77	0.012	10.76	6.78	0.089	13.15
BR3	356	4095	115	117	125	119	129	130	264	1.78	0.011	10.55	6.77	0.081	9.73
BR4	329	3784	114	116	123	118	130	128	117	1.76	0.012	10.78	6.73	0.090	12.90
DR	260	4257	111	204	155	115	110	117	114	1.75	0.012	10.91	6.80	0.091	15.05
ENT	287	1517	106	107	111	108	105	133	107	1.67	0.016	11.72	6.73	0.143	36.22
HAL	299	2155	110	109	114	110	158	131	110	1.67	0.014	11.43	6.68	0.122	27.07
KFA	317	5084	115	137	134	195	115	187	119	2.65	0.039	10.34	6.85	0.067	6.03
LR	199	2556	106	107	174	108	106	111	107	1.65	0.014	11.71	6.65	0.128	29.59
MBA	352	5313	136	120	129	123	118	125	121	1.81	0.011	10.27	6.75	0.072	5.38
MBR	235	2983	176	109	114	111	109	113	110	1.68	0.013	11.39	6.67	0.113	23.77

Table 21d - SIM2MLH zone 4-hr avg concentrations

	VOC1 (µg/m³)	VOC2 (µg/m³)	VOC3 (µg/m³)	VOC4 (µg/m³)	VOC5 (µg/m³)	VOC6 (µg/m³)	VOC7 (µg/m³)	VOC8 (µg/m³)	VOC9 (µg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (µg/m³)
BA2	697	NA	141	149	173	159	1783	207	154	2.89	0.025	10.20
BA3	809	NA	152	162	192	174	155	209	168	3.06	0.027	9.89
BR2	609	NA	132	140	158	146	189	206	142	2.69	0.022	10.58
BR3	624	NA	134	141	161	149	181	206	703	2.74	0.023	10.52
BR4	589	NA	132	138	156	146	182	202	141	2.67	0.023	10.68
DR	448	NA	127	446	306	139	128	158	136	2.58	0.021	10.89
ENT	528	NA	111	114	122	117	112	239	115	2.14	0.020	11.90
HAL	529	NA	116	118	127	121	246	229	120	2.26	0.020	11.58
KFA	549	NA	136	220	196	429	137	427	147	5.51	0.117	10.65
LR	304	NA	115	118	360	121	115	140	119	2.24	0.020	11.73
MBA	620	NA	226	148	172	157	145	181	153	2.87	0.024	10.23
MBR	363	NA	366	123	135	127	127	146	125	2.37	0.020	11.36

Table 21e - SIM2MLH zone 1-hr avg concentrations

	CO.1 (PPM)
BA2	3.37
BA3	3.50
BR2	3.19
BR3	3.23
BR4	3.21
DR	3.13
ENT	2.82
HAL	2.89
KFA	10.62
LR	2.92
MBA	3.36
MBR	2.94

LEGEND

VOC1	Burst - BMT	CO.1	Oven
VOC2	Floor	NO2.1	Oven
VOC3	Burst - MBR	PART.1	Oven
VOC4	Burst - DR	CO.2	Heater
VOC5	Burst - LR	NO2.2	Heater
VOC6	Burst - KFA	PART.2	Heater
VOC7	Burst - BA2	CO.3	Outdoor air
VOC8	Burst - GAR	NO2.3	Outdoor air
VOC9	Burst - BR3	PART.3	Outdoor air

Table 22a - SIM2MTC overall 24-hr avg concentrations

	VOC1 (μg/m³)	VOC2 (μg/m³)	VOC3 (μg/m³)	VOC4 (μg/m³)	VOC5 (μg/m³)	VOC6 (μg/m³)	VOC7 (μg/m³)	VOC8 (μg/m³)	VOC9 (μg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (μg/m³)	CO.2 (PPM)	NO2.2 (PPM)	PART.2 (μg/m³)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (μg/m³)
24 hr avg	640	11745	160	183	182	183	166	302	175	2.29	0.015	7.60	2.15	0.017	8.22	6.72	0.053	5.62

Table 22b - SIM2MTC zone peak concentrations

	VOC1 (μg/m³)	VOC2 (μg/m³)	VOC3 (μg/m³)	VOC4 (μg/m³)	VOC5 (μg/m³)	VOC6 (μg/m³)	VOC7 (μg/m³)	VOC8 (μg/m³)	VOC9 (μg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (μg/m³)	CO.2 (PPM)	NO2.2 (PPM)	PART.2 (μg/m³)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (μg/m³)
BA2	1533	8640	301	372	384	373	3583	520	376	4.76	0.083	7.59	4.00	0.129	10.42	8.93	0.073	1.49
BA3	1547	8580	310	384	395	385	308	521	387	4.81	0.087	7.62	4.01	0.134	10.48	8.93	0.075	0.56
BR2	1441	8033	283	353	354	352	287	503	346	4.51	0.074	8.83	3.84	0.116	10.51	9.00	0.083	13.96
BR3	1510	8629	292	365	367	365	300	517	1779	4.67	0.078	8.23	3.97	0.122	10.35	8.92	0.085	9.17
BR4	1510	8599	292	365	367	365	309	517	360	4.67	0.078	8.01	3.97	0.122	10.36	8.92	0.083	7.72
DR	1311	7220	263	1197	327	459	266	506	316	5.63	0.121	9.30	3.64	0.104	10.68	9.35	0.118	18.43
ENT	1331	7312	265	369	392	334	270	648	325	4.26	0.070	8.96	3.63	0.108	10.75	9.36	0.115	17.47
HAL	1435	8070	279	352	358	346	1670	592	475	4.48	0.063	8.51	3.85	0.105	10.49	8.99	0.097	12.73
KFA	1375	7518	271	337	338	875	275	753	327	11.22	0.347	8.70	3.74	0.108	10.47	9.00	0.098	11.02
LR	1287	7325	257	587	984	355	256	469	309	4.60	0.073	8.76	3.60	0.096	10.62	9.27	0.104	12.62
MBA	1531	8823	325	372	384	373	336	520	376	4.74	0.083	7.60	4.00	0.129	10.40	8.93	0.073	1.28
MBR	1427	8397	919	338	343	337	483	511	346	4.42	0.061	7.95	3.85	0.102	10.27	8.92	0.069	5.78

Table 22c - SIM2MTC zone 24-hr avg concentrations

	VOC1 (μg/m³)	VOC2 (μg/m³)	VOC3 (μg/m³)	VOC4 (μg/m³)	VOC5 (μg/m³)	VOC6 (μg/m³)	VOC7 (μg/m³)	VOC8 (μg/m³)	VOC9 (μg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (μg/m³)	CO.2 (PPM)	NO2.2 (PPM)	PART.2 (μg/m³)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (μg/m³)
BA2	715	7609	158	185	184	185	349	303	178	2.31	0.012	7.24	2.24	0.019	7.95	6.81	0.045	0.60
BA3	719	7505	158	185	184	185	162	303	179	2.31	0.013	7.23	2.24	0.019	7.94	6.81	0.045	0.42
BR2	654	7085	152	176	175	176	155	285	171	2.26	0.013	7.74	2.19	0.018	8.39	6.82	0.056	5.57
BR3	685	7352	155	180	180	181	159	293	261	2.28	0.013	7.52	2.21	0.018	8.20	6.81	0.051	3.50
BR4	690	7422	156	181	181	181	160	295	175	2.29	0.012	7.47	2.21	0.018	8.15	6.81	0.049	2.98
DR	590	6411	146	219	167	179	149	283	162	2.28	0.017	8.31	2.13	0.018	8.89	6.79	0.069	10.63
ENT	609	6473	148	174	177	171	151	333	165	2.18	0.013	8.12	2.15	0.020	8.78	6.76	0.063	8.39
HAL	651	7260	152	178	179	177	228	312	177	2.23	0.012	7.72	2.18	0.018	8.38	6.78	0.051	4.66
KFA	626	6776	150	172	172	212	152	344	167	2.57	0.028	7.98	2.18	0.020	8.63	6.79	0.057	6.41
LR	599	6760	147	190	213	174	150	273	164	2.22	0.014	8.18	2.12	0.017	8.75	6.79	0.063	8.98
MBA	715	7680	160	185	184	185	163	302	179	2.31	0.012	7.23	2.24	0.018	7.94	6.81	0.044	0.58
MBR	673	7733	199	180	180	180	178	300	176	2.27	0.011	7.48	2.20	0.016	8.15	6.80	0.046	3.05

Table 22d - SIM2MTC zone 4-hr avg concentrations

	VOC1 (μg/m³)	VOC2 (μg/m³)	VOC3 (μg/m³)	VOC4 (μg/m³)	VOC5 (μg/m³)	VOC6 (μg/m³)	VOC7 (μg/m³)	VOC8 (μg/m³)	VOC9 (μg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (μg/m³)	CO.2 (PPM)	NO2.2 (PPM)	PART.2 (μg/m³)
BA2	1211	NA	220	270	270	271	632	423	259	3.82	0.036	7.01	1.91	0.017	7.88
BA3	1226	NA	220	271	271	272	226	422	260	3.84	0.037	7.00	1.91	0.017	7.87
BR2	1127	NA	211	257	257	258	215	392	247	3.66	0.034	7.41	1.87	0.016	8.34
BR3	1193	NA	218	267	267	268	224	414	466	3.78	0.035	7.05	1.89	0.017	8.25
BR4	1190	NA	218	267	267	268	224	416	256	3.78	0.035	7.06	1.89	0.017	8.16
DR	999	NA	197	363	238	270	201	418	229	3.87	0.046	8.04	1.92	0.021	8.97
ENT	981	NA	195	244	249	238	198	576	226	3.44	0.032	8.02	2.11	0.035	9.08
HAL	1061	NA	204	254	256	251	437	479	251	3.59	0.031	7.49	1.98	0.023	8.44
KFA	1052	NA	203	246	246	344	207	606	237	5.03	0.093	7.78	2.09	0.033	9.01
LR	983	NA	196	294	347	250	199	371	228	3.59	0.035	8.01	1.89	0.017	8.70
MBA	1210	NA	224	270	270	271	228	418	259	3.82	0.036	7.00	1.91	0.017	7.87
MBR	1105	NA	325	257	258	257	271	412	249	3.65	0.030	7.26	1.91	0.017	8.09

Table 22e - SIM2MTC zone 1-hr avg concentrations

	CO.1 (PPM)	CO.2 (PPM)
BA2	3.81	2.08
BA3	3.92	2.08
BR2	3.61	2.01
BR3	3.70	2.03
BR4	3.70	2.04
DR	4.59	2.04
ENT	3.48	2.23
HAL	3.38	2.11
KFA	8.42	2.23
LR	3.65	2.02
MBA	3.79	2.08
MBR	3.35	2.07

LEGEND

VOC1	Burst - BMT	CO.1	Oven
VOC2	Floor	NO2.1	Oven
VOC3	Burst - MBR	PART.1	Oven
VOC4	Burst - DR	CO.2	Heater
VOC5	Burst - LR	NO2.2	Heater
VOC6	Burst - KFA	PART.2	Heater
VOC7	Burst - BA2	CO.3	Outdoor air
VOC8	Burst - GAR	NO2.3	Outdoor air
VOC9	Burst - BR3	PART.3	Outdoor air

Table 23a - SIM2MTM overall 24-hr avg concentrations

	VOC1	VOC2	VOC3	VOC4	VOC5	VOC6	VOC7	VOC8	VOC9	CO.1	NO2.1	PART.1	CO.2	NO2.2	PART.2	CO.3	NO2.3	PART.3
	(μg/m^3)	(μg/m^3)	(μg/m^3)	(μg/m^3)	(μg/m^3)	(μg/m^3)	(μg/m^3)	(μg/m^3)	(μg/m^3)	(PPM)	(PPM)	(μg/m^3)	(PPM)	(PPM)	(μg/m^3)	(PPM)	(PPM)	(μg/m^3)
24 hr avg	862	23366	184	202	220	216	207	261	195	2.55	0.016	7.96	2.44	0.012	8.85	6.58	0.040	6.77

Table 23b - SIM2MTM zone peak concentrations

	VOC1	VOC2	VOC3	VOC4	VOC5	VOC6	VOC7	VOC8	VOC9	CO.1	NO2.1	PART.1	CO.2	NO2.2	PART.2	CO.3	NO2.3	PART.3
	(μg/m^3)	(μg/m^3)	(μg/m^3)	(μg/m^3)	(μg/m^3)	(μg/m^3)	(μg/m^3)	(μg/m^3)	(μg/m^3)	(PPM)	(PPM)	(μg/m^3)	(PPM)	(PPM)	(μg/m^3)	(PPM)	(PPM)	(μg/m^3)
BA2	1707	15689	302	346	397	370	13124	424	376	4.38	0.051	8.82	3.57	0.102	11.41	8.26	0.047	7.39
BA3	1743	16091	316	364	418	389	302	416	395	4.56	0.055	8.49	3.68	0.109	11.43	8.24	0.050	0.91
BR2	1608	14434	275	314	360	337	501	422	341	4.11	0.045	9.88	3.40	0.090	11.32	8.75	0.059	14.61
BR3	1643	14994	283	323	370	346	419	418	4796	4.18	0.047	9.20	3.44	0.093	11.29	8.52	0.050	7.38
BR4	1512	12830	276	315	361	337	327	404	343	4.14	0.047	10.21	3.41	0.092	11.45	9.13	0.107	20.59
DR	1541	15668	259	3476	501	426	273	453	319	5.04	0.064	10.12	3.24	0.076	11.18	8.55	0.062	15.10
ENT	1431	11637	253	277	322	302	597	717	308	3.60	0.041	11.53	3.36	0.088	13.36	10.23	0.178	34.97
HAL	1357	12353	270	253	290	279	2848	642	346	3.36	0.032	11.27	3.08	0.075	13.04	10.16	0.161	28.44
KFA	1561	15547	263	318	342	2074	270	1392	324	22.62	0.664	10.05	3.87	0.077	10.86	8.30	0.042	5.87
LR	1355	13042	230	387	2415	289	281	317	274	3.57	0.037	10.93	2.82	0.063	11.64	9.28	0.104	22.24
MBA	1702	16257	489	345	396	369	340	408	376	4.38	0.051	9.21	3.53	0.101	11.41	8.27	0.050	10.49
MBR	1399	14306	2003	265	299	292	466	379	276	3.48	0.034	10.69	2.95	0.068	11.85	8.75	0.076	18.97

Table 23c - SIM2MTM zone 24-hr avg concentrations

	VOC1	VOC2	VOC3	VOC4	VOC5	VOC6	VOC7	VOC8	VOC9	CO.1	NO2.1	PART.1	CO.2	NO2.2	PART.2	CO.3	NO2.3	PART.3
	(μg/m^3)	(μg/m^3)	(μg/m^3)	(μg/m^3)	(μg/m^3)	(μg/m^3)	(μg/m^3)	(μg/m^3)	(μg/m^3)	(PPM)	(PPM)	(μg/m^3)	(PPM)	(PPM)	(μg/m^3)	(PPM)	(PPM)	(μg/m^3)
BA2	1058	12987	173	196	214	209	1060	256	195	2.44	0.007	7.32	2.63	0.011	8.41	6.70	0.025	1.68
BA3	1116	13257	179	204	222	218	194	258	203	2.52	0.007	7.07	2.69	0.012	8.21	6.72	0.021	0.34
BR2	952	12009	164	184	201	195	211	247	184	2.35	0.007	7.82	2.54	0.011	8.81	6.75	0.033	4.21
BR3	1001	12559	168	189	207	201	206	252	522	2.39	0.007	7.57	2.59	0.011	8.62	6.73	0.029	2.82
BR4	861	10654	157	176	191	187	176	225	175	2.31	0.008	8.38	2.46	0.012	9.28	6.80	0.049	8.43
DR	932	12638	165	450	231	218	179	248	184	2.61	0.010	7.69	2.52	0.010	8.61	6.71	0.030	3.67
ENT	760	7367	137	150	167	155	161	259	148	2.05	0.010	9.53	2.42	0.023	10.58	6.77	0.082	19.95
HAL	748	8603	143	155	171	161	274	241	157	2.09	0.009	9.28	2.39	0.018	10.21	6.77	0.071	15.82
KFA	981	13086	168	195	207	375	181	405	189	4.17	0.054	7.65	2.73	0.016	8.79	6.69	0.023	1.76
LR	757	10206	148	180	342	173	164	211	162	2.20	0.008	8.71	2.34	0.010	9.46	6.75	0.054	10.53
MBA	1017	12951	201	192	210	205	193	246	191	2.41	0.007	7.42	2.59	0.011	8.45	6.70	0.026	1.92
MBR	821	11368	303	169	184	178	190	226	169	2.21	0.007	8.32	2.41	0.010	9.17	6.71	0.042	7.50

Table 23d - SIM2MTM zone 4-hr avg concentrations

	VOC1	VOC2	VOC3	VOC4	VOC5	VOC6	VOC7	VOC8	VOC9	CO.1	NO2.1	PART.1	CO.2	NO2.2	PART.2
	(μg/m^3)	(μg/m^3)	(μg/m^3)	(μg/m^3)	(μg/m^3)	(μg/m^3)	(μg/m^3)	(μg/m^3)	(μg/m^3)	(PPM)	(PPM)	(μg/m^3)	(PPM)	(PPM)	(μg/m^3)
BA2	1164	NA	208	247	283	263	1931	328	252	3.24	0.017	8.16	2.44	0.010	7.23
BA3	1274	NA	228	272	306	293	238	313	278	3.53	0.018	7.72	2.45	0.010	7.12
BR2	1040	NA	193	228	262	240	281	324	232	3.08	0.015	8.71	2.43	0.011	7.55
BR3	1087	NA	198	235	270	249	268	325	947	3.13	0.016	8.50	2.43	0.011	7.37
BR4	1003	NA	192	226	258	239	235	301	229	3.11	0.017	9.07	2.31	0.011	8.00
DR	982	NA	199	854	335	313	205	314	239	3.84	0.022	8.32	2.48	0.012	7.38
ENT	814	NA	140	162	208	162	146	387	156	2.35	0.016	10.79	2.81	0.053	10.58
HAL	843	NA	146	169	213	171	426	372	170	2.43	0.015	10.46	2.52	0.029	9.57
KFA	993	NA	197	236	258	640	204	811	236	10.47	0.212	9.05	3.06	0.045	8.90
LR	646	NA	159	229	564	193	163	212	182	2.69	0.015	9.94	2.34	0.013	8.27
MBA	1074	NA	303	237	269	252	252	298	242	3.14	0.016	8.29	2.43	0.010	7.17
MBR	779	NA	442	184	213	192	256	281	187	2.61	0.014	9.60	2.36	0.011	7.88

Table 23e - SIM2MTM zone 1-hr avg concentrations

	CO.1	CO.2
	(PPM)	(PPM)
BA2	2.24	2.51
BA3	2.26	2.52
BR2	2.30	2.52
BR3	2.27	2.51
BR4	2.40	2.35
DR	2.29	2.58
ENT	2.38	3.12
HAL	2.40	2.70
KFA	16.55	3.44
LR	2.39	2.39
MBA	2.23	2.49
MBR	2.27	2.43

LEGEND

VOC1	Burst - BMT	CO.1	Oven
VOC2	Floor	NO2.1	Oven
VOC3	Burst - MBR	PART.1	Oven
VOC4	Burst - DR	CO.2	Heater
VOC5	Burst - LR	NO2.2	Heater
VOC6	Burst - KFA	PART.2	Heater
VOC7	Burst - BA2	CO.3	Outdoor air
VOC8	Burst - GAR	NO2.3	Outdoor air
VOC9	Burst - BR3	PART.3	Outdoor air

Table 24a - SIM2MTH overall 24-hr avg concentrations

	VOC1 (μg/m³)	VOC2 (μg/m³)	VOC3 (μg/m³)	VOC4 (μg/m³)	VOC5 (μg/m³)	VOC6 (μg/m³)	VOC7 (μg/m³)	VOC8 (μg/m³)	VOC9 (μg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (μg/m³)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (μg/m³)
24 hr avg	802	21581	184	205	218	210	200	232	197	2.60	0.015	7.78	6.83	0.041	6.13

Table 24b - SIM2MTH zone peak concentrations

	VOC1 (μg/m³)	VOC2 (μg/m³)	VOC3 (μg/m³)	VOC4 (μg/m³)	VOC5 (μg/m³)	VOC6 (μg/m³)	VOC7 (μg/m³)	VOC8 (μg/m³)	VOC9 (μg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (μg/m³)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (μg/m³)
BA2	1787	19708	326	372	416	383	12685	328	393	4.62	0.082	7.48	8.61	0.053	3.56
BA3	1802	25067	336	383	430	396	347	330	405	4.81	0.089	7.42	8.61	0.055	0.67
BR2	1662	16995	313	356	389	364	389	319	364	4.36	0.070	8.46	8.60	0.059	7.29
BR3	1756	18378	320	365	398	373	407	321	4725	4.40	0.073	8.13	8.60	0.052	5.14
BR4	1742	16877	318	362	396	370	462	320	370	4.37	0.073	8.42	8.61	0.053	7.60
DR	1644	22011	305	3309	477	411	314	347	354	5.02	0.094	7.98	8.59	0.055	7.50
ENT	1412	11711	268	302	329	308	349	630	309	3.89	0.064	11.09	9.93	0.171	34.59
HAL	1657	13536	300	337	372	345	2583	490	362	3.97	0.049	10.87	9.21	0.137	25.87
KFA	1748	19698	310	380	387	2024	320	750	359	17.63	0.591	8.81	8.66	0.049	2.21
LR	1396	14588	267	375	2259	312	273	299	307	3.77	0.055	10.14	9.15	0.097	17.64
MBA	1783	18821	451	371	416	382	342	322	392	4.62	0.082	8.21	8.62	0.053	3.88
MBR	1497	13989	1857	313	343	321	369	284	321	3.84	0.051	9.97	8.88	0.087	15.43

Table 24c - SIM2MTH zone 24-hr avg concentrations

	VOC1 (μg/m³)	VOC2 (μg/m³)	VOC3 (μg/m³)	VOC4 (μg/m³)	VOC5 (μg/m³)	VOC6 (μg/m³)	VOC7 (μg/m³)	VOC8 (μg/m³)	VOC9 (μg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (μg/m³)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (μg/m³)
BA2	992	13039	181	205	221	210	745	215	204	2.67	0.009	7.13	7.12	0.028	1.14
BA3	1109	14423	195	222	240	228	208	219	220	3.00	0.010	6.41	7.42	0.024	0.42
BR2	903	12080	172	193	209	197	196	211	192	2.52	0.009	7.58	7.04	0.033	3.12
BR3	946	12648	177	199	215	203	201	214	431	2.57	0.009	7.35	7.06	0.029	1.80
BR4	910	12158	174	195	211	200	200	206	195	2.53	0.009	7.55	7.01	0.033	2.91
DR	905	13781	178	392	239	223	187	232	199	2.81	0.010	7.20	7.20	0.029	2.68
ENT	662	6335	142	155	169	156	152	212	153	2.06	0.012	9.59	6.77	0.088	20.82
HAL	743	8265	152	167	182	168	299	208	169	2.14	0.010	8.84	6.73	0.060	10.76
KFA	910	13172	178	207	216	327	187	404	199	3.90	0.044	7.20	7.19	0.025	1.01
LR	649	9781	152	184	293	171	160	172	166	2.23	0.010	8.83	6.85	0.058	11.14
MBA	929	12832	200	199	214	203	194	202	198	2.57	0.009	7.36	7.02	0.028	1.26
MBR	717	9882	260	171	183	173	180	183	170	2.22	0.009	8.57	6.81	0.050	8.31

Table 24d - SIM2MTH zone 4- hr avg concentrations

	VOC1 (μg/m³)	VOC2 (μg/m³)	VOC3 (μg/m³)	VOC4 (μg/m³)	VOC5 (μg/m³)	VOC6 (μg/m³)	VOC7 (μg/m³)	VOC8 (μg/m³)	VOC9 (μg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (μg/m³)
BA2	1252	NA	226	266	298	277	2261	271	271	3.88	0.031	7.14
BA3	1332	NA	235	278	309	290	250	267	280	3.97	0.033	7.07
BR2	1164	NA	217	255	285	265	279	267	260	3.74	0.027	7.23
BR3	1187	NA	220	258	289	269	276	268	1116	3.77	0.028	7.22
BR4	1162	NA	217	254	285	265	277	265	260	3.74	0.028	7.32
DR	1116	NA	216	920	359	303	226	264	256	4.12	0.034	7.25
ENT	825	NA	155	176	216	178	184	405	176	2.84	0.024	9.71
HAL	880	NA	171	195	230	199	546	347	212	3.13	0.022	8.67
KFA	1099	NA	214	265	278	677	223	611	253	7.69	0.151	7.74
LR	812	NA	180	252	655	216	193	220	208	3.23	0.023	8.62
MBA	1205	NA	301	262	292	273	250	252	266	3.84	0.030	7.19
MBR	888	NA	569	214	239	222	259	231	220	3.30	0.022	8.14

Table 24e - SIM2MTH zone 1-hr avg concentrations

	CO.1 (PPM)
BA2	3.25
BA3	3.37
BR2	3.06
BR3	3.10
BR4	3.10
DR	3.40
ENT	2.95
HAL	2.81
KFA	12.17
LR	2.89
MBA	3.23
MBR	2.81

LEGEND

VOC1	Burst - BMT	CO.1	Oven
VOC2	Floor	NO2.1	Oven
VOC3	Burst - MBR	PART.1	Oven
VOC4	Burst - DR	CO.2	Heater
VOC5	Burst - LR	NO2.2	Heater
VOC6	Burst - KFA	PART.2	Heater
VOC7	Burst - BA2	CO.3	Outdoor air
VOC8	Burst - GAR	NO2.3	Outdoor air
VOC9	Burst - BR3	PART.3	Outdoor air

Table 25a - SIM1FLCF overall 24-hr avg concentrations

	VOC1 ($\mu g/m^3$)	VOC2 ($\mu g/m^3$)	VOC3 ($\mu g/m^3$)	VOC4 ($\mu g/m^3$)	VOC5 ($\mu g/m^3$)	VOC6 ($\mu g/m^3$)	VOC7 ($\mu g/m^3$)	VOC8 ($\mu g/m^3$)	VOC9 ($\mu g/m^3$)	CO.1 ppm	NO2.1 ppm	PART.1 ($\mu g/m^3$)	CO.2 ppm	NO2.2 ppm	PART.2 ($\mu g/m^3$)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 ($\mu g/m^3$)
24 hr avg	265	6067	218	183	117	225	219	217	205	2.75	0.026	9.26	1.60	0.008	9.17	6.77	0.079	14.52

Table 25b - SIM1FLCF zone peak concentrations

	VOC1 ($\mu g/m^3$)	VOC2 ($\mu g/m^3$)	VOC3 ($\mu g/m^3$)	VOC4 ($\mu g/m^3$)	VOC5 ($\mu g/m^3$)	VOC6 ($\mu g/m^3$)	VOC7 ($\mu g/m^3$)	VOC8 ($\mu g/m^3$)	VOC9 ($\mu g/m^3$)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 ($\mu g/m^3$)	CO.2 (PPM)	NO2.2 (PPM)	PART.2 ($\mu g/m^3$)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 ($\mu g/m^3$)
BA2	303	11815	645	232	131	393	347	13163	281	4.93	0.056	8.31	2.25	0.010	8.31	9.48	0.104	8.89
BR2	185	9465	384	197	126	314	271	253	234	4.10	0.047	10.14	2.35	0.017	10.13	9.84	0.165	22.86
BR3	164	10907	672	206	126	347	354	274	4099	4.57	0.046	9.36	2.30	0.011	9.36	9.65	0.107	16.59
HAL	333	7967	1630	303	177	462	596	390	407	5.50	0.083	11.36	2.46	0.017	11.35	10.15	0.166	26.29
KIT	141	7974	297	274	160	4332	255	258	236	44.43	1.434	14.46	2.41	0.014	11.07	10.00	0.140	23.94
LDA	138	7537	337	1593	416	482	258	237	215	6.14	0.089	10.64	2.42	0.013	10.68	10.03	0.132	19.44
MBA	142	6409	293	208	125	312	9360	266	247	3.92	0.054	11.93	2.51	0.019	11.93	10.35	0.191	33.43
MBR	155	6516	2430	178	120	256	752	221	214	3.33	0.045	11.80	2.51	0.021	11.80	10.34	0.210	35.49

Table 25c - SIM1FLCF zone 24-hr avg concentrations

	VOC1 ($\mu g/m^3$)	VOC2 ($\mu g/m^3$)	VOC3 ($\mu g/m^3$)	VOC4 ($\mu g/m^3$)	VOC5 ($\mu g/m^3$)	VOC6 ($\mu g/m^3$)	VOC7 ($\mu g/m^3$)	VOC8 ($\mu g/m^3$)	VOC9 ($\mu g/m^3$)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 ($\mu g/m^3$)	CO.2 (PPM)	NO2.2 (PPM)	PART.2 ($\mu g/m^3$)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 ($\mu g/m^3$)
BA2	134	8418	255	138	109	190	200	1915	160	2.38	0.009	7.13	1.61	0.005	7.09	6.80	0.047	3.48
BR2	112	6422	172	124	106	157	155	149	137	2.09	0.010	8.98	1.61	0.007	8.95	6.81	0.075	13.07
BR3	113	8211	252	132	107	178	196	165	727	2.30	0.009	7.73	1.62	0.005	7.69	6.82	0.050	5.13
HAL	123	5249	316	128	108	177	223	155	145	2.32	0.016	9.75	1.60	0.009	9.70	6.77	0.086	16.09
KIT	105	5540	149	133	109	647	142	142	132	6.59	0.124	9.80	1.60	0.008	9.28	6.74	0.084	15.70
LDA	106	6040	162	312	141	206	147	141	131	2.62	0.018	9.26	1.61	0.008	9.18	6.77	0.076	13.63
MBA	104	4130	136	116	103	136	1051	133	125	1.92	0.013	10.03	1.59	0.010	10.02	6.71	0.105	22.29
MBR	107	3982	345	113	103	129	256	127	122	1.85	0.012	10.54	1.59	0.011	10.52	6.72	0.108	24.41

Table 25d - SIM1FLCF zone 4-hr avg concentrations

	VOC1 ($\mu g/m^3$)	VOC2 ($\mu g/m^3$)	VOC3 ($\mu g/m^3$)	VOC4 ($\mu g/m^3$)	VOC5 ($\mu g/m^3$)	VOC6 ($\mu g/m^3$)	VOC7 ($\mu g/m^3$)	VOC8 ($\mu g/m^3$)	VOC9 ($\mu g/m^3$)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 ($\mu g/m^3$)	CO.2 (PPM)	NO2.2 (PPM)	PART.2 ($\mu g/m^3$)
BA2	147	NA	449	170	118	276	274	5479	204	3.51	0.015	7.27	1.55	0.007	6.82
BR2	114	NA	289	145	113	209	202	175	167	2.93	0.012	8.78	1.66	0.012	9.20
BR3	114	NA	426	153	114	243	249	190	1958	3.36	0.015	7.98	1.54	0.007	7.27
HAL	138	NA	770	168	126	327	394	200	213	4.21	0.036	9.89	1.65	0.012	9.66
KIT	104	NA	186	181	126	1808	168	170	161	23.65	0.515	11.79	1.60	0.011	8.84
LDA	105	NA	204	768	244	325	164	160	151	5.09	0.046	9.66	1.59	0.010	8.71
MBA	102	NA	181	137	108	174	3126	159	152	2.59	0.013	10.23	1.64	0.013	9.52
MBR	108	NA	922	133	108	164	551	150	152	2.47	0.012	10.50	1.69	0.015	10.54

Table 25e - SIM1FLCF zone 1-hr avg concentrations

	CO.1 (PPM)	CO.2 (PPM)
BA2	2.54	1.67
BR2	2.52	1.68
BR3	2.58	1.65
HAL	3.54	1.66
KIT	33.72	1.64
LDA	3.87	1.65
MBA	2.55	1.63
MBR	2.52	1.64

LEGEND

VOC1	Burst - UCL	CO.1	Oven
VOC2	Floor	NO2.1	Oven
VOC3	Burst - MBR	PART.1	Oven
VOC4	Burst - LDA	CO.2	Heater
VOC5	Burst - GAR	NO2.2	Heater
VOC6	Burst - KIT	PART.2	Heater
VOC7	Burst - MBA	CO.3	Outdoor air
VOC8	Burst - BA2	NO2.3	Outdoor air
VOC9	Burst - BR3	PART.3	Outdoor air

Table 26a - SIM1FLCH overall 24-hr avg concentrations

	VOC1 (µg/m³)	VOC2 (µg/m³)	VOC3 (µg/m³)	VOC4 (µg/m³)	VOC5 (µg/m³)	VOC6 (µg/m³)	VOC7 (µg/m³)	VOC8 (µg/m³)	VOC9 (µg/m³)	CO.1 ppm	NO2.1 ppm	PART.1 (µg/m³)	CO.2 ppm	NO2.2 ppm	PART.2 (µg/m³)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (µg/m³)
24 hr avg	263	5563	209	178	116	216	211	208	199	2.68	0.026	11.02	1.61	0.008	10.92	6.79	0.084	14.74

Table 26b - SIM1FLCH zone peak concentrations

	VOC1 (µg/m³)	VOC2 (µg/m³)	VOC3 (µg/m³)	VOC4 (µg/m³)	VOC5 (µg/m³)	VOC6 (µg/m³)	VOC7 (µg/m³)	VOC8 (µg/m³)	VOC9 (µg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (µg/m³)	CO.2 (PPM)	NO2.2 (PPM)	PART.2 (µg/m³)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (µg/m³)
BA2	302	10953	638	209	125	347	319	13153	249	4.49	0.051	10.74	2.32	0.013	10.73	9.73	0.134	8.90
BR2	184	8998	352	180	123	279	247	225	210	3.78	0.044	11.59	2.40	0.018	11.58	10.04	0.179	22.99
BR3	156	10390	666	189	121	310	332	245	4094	4.24	0.042	10.72	2.36	0.012	10.70	9.86	0.124	16.59
HAL	332	7338	1627	287	174	431	594	365	390	5.21	0.080	11.93	2.50	0.017	11.91	10.32	0.171	26.38
KIT	134	7348	268	257	157	4328	231	230	212	44.46	1.435	15.81	2.46	0.015	11.62	10.19	0.154	23.95
LDA	131	7200	313	1591	414	478	236	212	195	6.16	0.090	11.32	2.47	0.014	11.25	10.20	0.141	19.44
MBA	134	5807	261	189	120	275	9358	236	221	3.54	0.050	12.16	2.57	0.019	12.16	10.57	0.191	33.44
MBR	149	6067	2428	164	118	228	750	199	200	3.06	0.042	12.19	2.55	0.021	12.19	10.50	0.213	35.56

Table 26c - SIM1FLCH zone 24-hr avg concentrations

	VOC1 (µg/m³)	VOC2 (µg/m³)	VOC3 (µg/m³)	VOC4 (µg/m³)	VOC5 (µg/m³)	VOC6 (µg/m³)	VOC7 (µg/m³)	VOC8 (µg/m³)	VOC9 (µg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (µg/m³)	CO.2 (PPM)	NO2.2 (PPM)	PART.2 (µg/m³)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (µg/m³)
BA2	132	7558	240	131	107	173	186	1899	148	2.26	0.009	10.11	1.62	0.006	10.05	6.84	0.056	3.83
BR2	111	5888	162	119	105	147	146	140	130	2.01	0.010	10.82	1.61	0.008	10.79	6.83	0.080	13.30
BR3	111	7485	240	126	106	165	184	153	717	2.19	0.009	10.23	1.62	0.006	10.19	6.85	0.057	5.41
HAL	121	4824	309	124	107	169	216	148	139	2.25	0.016	11.24	1.60	0.009	11.18	6.78	0.090	16.29
KIT	104	5032	140	129	108	638	134	133	126	6.51	0.124	11.59	1.60	0.009	11.06	6.76	0.089	15.95
LDA	104	5545	154	308	140	197	139	133	125	2.55	0.019	10.99	1.62	0.008	10.91	6.79	0.081	13.84
MBA	103	3712	129	113	102	128	1044	126	120	1.85	0.013	11.54	1.59	0.011	11.52	6.72	0.110	22.54
MBR	106	3669	339	110	102	123	251	121	118	1.80	0.013	11.64	1.59	0.011	11.62	6.73	0.112	24.58

Table 26d - SIM1FLCH zone 4-hr avg concentrations

	VOC1 (µg/m³)	VOC2 (µg/m³)	VOC3 (µg/m³)	VOC4 (µg/m³)	VOC5 (µg/m³)	VOC6 (µg/m³)	VOC7 (µg/m³)	VOC8 (µg/m³)	VOC9 (µg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (µg/m³)	CO.2 (PPM)	NO2.2 (PPM)	PART.2 (µg/m³)
BA2	145	NA	426	158	115	251	256	5458	186	3.41	0.015	9.74	1.59	0.008	10.44
BR2	113	NA	274	138	111	193	190	162	156	2.86	0.012	10.39	1.68	0.013	11.30
BR3	112	NA	408	144	112	224	235	174	1945	3.29	0.015	9.95	1.58	0.008	10.46
HAL	137	NA	757	162	125	313	384	189	204	4.14	0.036	11.10	1.67	0.013	11.47
KIT	103	NA	172	173	124	1793	157	158	150	23.57	0.515	13.20	1.63	0.012	11.18
LDA	104	NA	192	761	243	311	155	149	142	5.03	0.046	10.98	1.61	0.011	11.03
MBA	102	NA	169	130	106	161	3116	148	143	2.51	0.013	11.41	1.66	0.014	11.55
MBR	108	NA	912	127	107	153	543	141	144	2.41	0.012	11.42	1.70	0.016	11.87

Table 26e - SIM1FLCH zone 1-hr avg concentrations

	CO.1 (PPM)	CO.2 (PPM)
BA2	2.58	1.70
BR2	2.55	1.69
BR3	2.62	1.68
HAL	3.56	1.67
KIT	33.75	1.66
LDA	3.90	1.67
MBA	2.58	1.64
MBR	2.54	1.64

LEGEND

VOC1	Burst - UCL	CO.1	Oven
VOC2	Floor	NO2.1	Oven
VOC3	Burst - MBR	PART.1	Oven
VOC4	Burst - LDA	CO.2	Heater
VOC5	Burst - GAR	NO2.2	Heater
VOC6	Burst - KIT	PART.2	Heater
VOC7	Burst - MBA	CO.3	Outdoor air
VOC8	Burst - BA2	NO2.3	Outdoor air
VOC9	Burst - BR3	PART.3	Outdoor air

Table 27a - SIM1FLCHO overall 24-hr avg concentrations

	VOC1 (µg/m³)	VOC2 (µg/m³)	VOC3 (µg/m³)	VOC4 (µg/m³)	VOC5 (µg/m³)	VOC6 (µg/m³)	VOC7 (µg/m³)	VOC8 (µg/m³)	VOC9 (µg/m³)	CO.1 ppm	NO2.1 ppm	PART.1 (µg/m³)	CO.2 ppm	NO2.2 ppm	PART.2 (µg/m³)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (µg/m³)
24 hr avg	253	5717	212	178	112	220	214	211	200	2.71	0.026	10.97	1.60	0.008	10.87	6.78	0.082	14.38

Table 27b - SIM1FLCHO zone peak concentrations

	VOC1 (µg/m³)	VOC2 (µg/m³)	VOC3 (µg/m³)	VOC4 (µg/m³)	VOC5 (µg/m³)	VOC6 (µg/m³)	VOC7 (µg/m³)	VOC8 (µg/m³)	VOC9 (µg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (µg/m³)	CO.2 (PPM)	NO2.2 (PPM)	PART.2 (µg/m³)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (µg/m³)
BA2	288	11241	640	204	116	354	323	13162	252	4.54	0.051	10.71	2.28	0.013	10.70	9.61	0.132	8.89
BR2	179	9171	368	178	116	289	255	237	214	3.86	0.044	11.56	2.37	0.017	11.56	9.93	0.174	22.89
BR3	151	10610	669	185	116	319	336	252	4097	4.30	0.042	10.66	2.33	0.012	10.62	9.76	0.120	16.57
HAL	318	7561	1629	280	154	448	594	380	396	5.34	0.081	11.92	2.47	0.017	11.90	10.21	0.170	26.24
KIT	131	7487	272	236	135	4332	235	238	216	44.51	1.437	15.75	2.43	0.015	11.61	10.09	0.150	23.92
LDA	129	7323	320	1591	364	480	240	218	198	6.16	0.090	11.29	2.44	0.014	11.24	10.11	0.136	19.43
MBA	132	5954	272	186	112	283	9359	246	224	3.60	0.050	12.16	2.54	0.019	12.16	10.46	0.191	33.42
MBR	143	6221	2429	162	111	235	751	208	203	3.11	0.042	12.18	2.52	0.021	12.18	10.40	0.212	35.45

Table 27c - SIM1FLCHO zone 24-hr avg concentrations

	VOC1 (µg/m³)	VOC2 (µg/m³)	VOC3 (µg/m³)	VOC4 (µg/m³)	VOC5 (µg/m³)	VOC6 (µg/m³)	VOC7 (µg/m³)	VOC8 (µg/m³)	VOC9 (µg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (µg/m³)	CO.2 (PPM)	NO2.2 (PPM)	PART.2 (µg/m³)	CO.3 (PPM)	NO2.3 (PPM)	PART.3 (µg/m³)
BA2	127	7754	245	129	104	177	190	1907	150	2.28	0.009	10.05	1.61	0.005	9.99	6.82	0.054	3.64
BR2	109	6075	166	118	103	150	149	143	131	2.04	0.010	10.76	1.61	0.008	10.73	6.82	0.078	12.91
BR3	109	7704	245	125	104	168	188	157	722	2.22	0.009	10.17	1.62	0.006	10.12	6.84	0.055	5.08
HAL	119	4968	313	123	105	172	219	151	141	2.27	0.016	11.19	1.60	0.009	11.13	6.77	0.089	15.92
KIT	103	5158	142	125	105	651	136	136	127	6.61	0.125	11.56	1.60	0.009	11.02	6.75	0.088	15.64
LDA	103	5720	157	308	132	201	141	136	126	2.58	0.019	10.94	1.61	0.008	10.86	6.78	0.079	13.46
MBA	102	3834	131	112	101	130	1050	128	121	1.87	0.013	11.50	1.59	0.011	11.48	6.71	0.109	22.14
MBR	105	3784	343	110	101	125	254	123	119	1.81	0.012	11.60	1.59	0.011	11.58	6.72	0.111	24.17

Table 27d - SIM1FLCHO zone 4-hr avg concentrations

	VOC1 (µg/m³)	VOC2 (µg/m³)	VOC3 (µg/m³)	VOC4 (µg/m³)	VOC5 (µg/m³)	VOC6 (µg/m³)	VOC7 (µg/m³)	VOC8 (µg/m³)	VOC9 (µg/m³)	CO.1 (PPM)	NO2.1 (PPM)	PART.1 (µg/m³)	CO.2 (PPM)	NO2.2 (PPM)	PART.2 (µg/m³)
BA2	138	NA	433	156	108	256	260	5468	189	3.40	0.014	9.65	1.59	0.008	10.41
BR2	111	NA	281	137	107	198	194	168	158	2.87	0.012	10.31	1.68	0.013	11.26
BR3	110	NA	417	143	107	230	240	181	1955	3.30	0.015	9.86	1.57	0.008	10.41
HAL	134	NA	765	160	116	320	389	195	206	4.16	0.036	11.05	1.67	0.013	11.44
KIT	103	NA	177	163	114	1819	160	163	152	23.74	0.516	13.16	1.63	0.012	11.15
LDA	103	NA	197	764	214	318	158	154	143	5.05	0.046	10.92	1.61	0.010	10.99
MBA	101	NA	173	129	103	164	3125	152	144	2.52	0.013	11.37	1.66	0.014	11.51
MBR	107	NA	920	127	104	156	548	145	146	2.41	0.012	11.38	1.70	0.015	11.84

Table 27e - SIM1FLCHO zone 1-hr avg concentrations

	CO.1 (PPM)	CO.2 (PPM)
BA2	2.55	1.70
BR2	2.53	1.69
BR3	2.59	1.68
HAL	3.54	1.67
KIT	33.82	1.66
LDA	3.88	1.66
MBA	2.56	1.64
MBR	2.52	1.64

LEGEND

VOC1	Burst - UCL	CO.1	Oven
VOC2	Floor	NO2.1	Oven
VOC3	Burst - MBR	PART.1	Oven
VOC4	Burst - LDA	CO.2	Heater
VOC5	Burst - GAR	NO2.2	Heater
VOC6	Burst - KIT	PART.2	Heater
VOC7	Burst - MBA	CO.3	Outdoor air
VOC8	Burst - BA2	NO2.3	Outdoor air
VOC9	Burst - BR3	PART.3	Outdoor air